JOURNAL

OF THE

Michigan Schoolmasters' Club

FORTY-EIGHTH MEETING
Held in Ann Arbor, April 2, 3, 4, 1913

ANN ARBOR, MICHIGAN
PUBLISHED BY THE CLUB

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Michigan Schoolmasters' Club

PROCEEDINGS OF THE FORTY-EIGHTH MEETING, HELD AT ANN ARBOR, APRIL 2, 3, 4, 1913.

EDITED BY THE SECRETARY.

GENERAL MEETING

The forty-eighth meeting of the Michigan Schoolmasters' Club began on Wednesday, April 2, with meetings of the Classical and the Modern Language Conferences of the club, and a Demonstration of Gymnastic Games and Dances, by the young ladies of the University, in Barbour Gymnasium. In the evening, in the Physics Lecture Room, an address upon "A Botanist's Travels in Mexico" was given by Professor C. J. Chamberlain of the University of Chicago.

The General Sessions of the Club were held on Thursday and Friday mornings. Thursday morning was given over to the teachers of Biology. Professor Maurice A. Bigelow, of Columbia University, read a paper entitled "High School Biological Sciences as Related to Human Life." Dr. J. G. Coulter, of Bloomington, Illinois, made "A Report upon the Study of Science in High Schools." On Friday morning the general subject for consideration was "The Origin, Function, and Product of the High School." Honorable Luther L. Wright, Superintendent of Public Instruction of Michigan, spoke upon "The Function of the High School," Professor R. M. Wenley of the University of Michigan upon "The Social Origins of the School," and Professor J. L. Markley of the University of Michigan upon "The Product of the High School." The papers of Mr. Wright and Mr. Markley have been received by the Secretary and are published in this number of the proceedings. They should be read by everybody ,for much food for thought can be obtained from each of them.

The banquet to alumnæ and former students of the university was given up and the money collected for the banquet was magnanimously donated by the women to relieve the suffering in the flooded districts of Ohio. The Junior Girls' Play, however, was given as planned.

On Thursday and Friday the club enjoyed a treat in listening to two illustrated lectures upon "The Industrial and Religious Arts of the Ancient

Orient," given by Professor Karl Bezold of the University of Heidelberg, Germany, whom President Hutchins introduced as one of the highest authorities in Europe on ancient art.

On Thursday evening Professor Dayton C. Miller, of the Case School of Applied Science of Cleveland, Ohio, gave, to an audience capable of appreciating it, the finest illustrated lecture on the subject of sound waves ever given in University Hall. To describe it is impossible. One must see the actual work of analysis performed and hear the explanations in order to fully understand and appreciate the success Professor Miller has made in photographing and analyzing sound waves.

On Thursday evening, also, a fine musical program was given to the members of the club in the High School auditorium by the University School of Music.

During the day there were held eight conferences, Classical, Modern Language Physics and Chemistry, Biology, Commercial, Educational Psychology, History, and Manual Training.

On Friday ten conferences held sessions: Classical, Modern Language, English, Physics and Chemistry, Mathematics, History, Drawing, Biology, Physiography, and Commercial.

Informal receptions were held at the Michigan Union on Thursday and Fridays evenings from seven to eight o'clock.

Special meetings of the Principals' Club, Federation of Teachers' Clubs, and of the Michigan Interscholastic Athletic Association, were held during the week.

On Friday evening Mr. Paul E. More, Editor of *The Nation,* gave an excellent address on "The Paradox of Oxford."

On account of a forty-eight hour rain the attendance was not as large as last year's record breaker, although the Friday morning meeting was one of the largest ever held.

The complete program of the club is printed at the end of the proceedings. This year the Secretary will publish all papers handed to him by the first week in May.

THE FUNCTION OF THE HIGH SCHOOL.

HON. LUTHER L. WRIGHT, SUPERINTENDENT OF PUBLIC INSTRUCTION OF MICHIGAN.

I believe in the American public school and in the ideals for which it stands. The muckraking magazines have been so condemning and belittling the system, there are so many little yelpers baying in the chorus that one hesitates to discuss his own problems lest he be counted among those who discredit the public schools.

Yet I think there may be some basis for criticism. This dissatisfaction with public school purposes and conditions is quite widespread. In this discussion I am trying to look at it from the standpoint not of the school teacher, but of the citizen and business man. Viewed from this standpoint the function of the public high school paid for by common taxation is threefold.

First. To give a pupil training that will aid him in making a living.

Second. To give culture that he may enjoy living.

Third. To so train his intelligence that he shall be a good citizen.

From another viewpoint we may give as the function of the high school:

First. To prepare those who are going to college.

Second. To prepare those who are not going to college.

Each of these in my judgment equals the other in importance and differs from it. Much has been done for the first; not much for the second. A small per cent only of those who enter the high school go to the college. We may not do any less for those who do go, but I think we must do more and differently for those who are not to go.

In the evolution of our civilization the high school came into existence to satisfy a demand of the American people for a broader education than the elementary schools afforded. The only preparatory schools for college were the academies:—the high school took the place of the academy. The idea that young people were to be prepared for college at public expense is comparatively recent. The principle of taxation for the support of the high school was established in 1874 in the celebrated case, Kalamazoo vs. Stuart. In this case the Supreme Court of Michigan justified a public tax for the support of a high school.

With the evolution of educational ideas has come a new notion of what constitutes education and also what constitutes preparation for living. The schools of the past were aristocratic or professional in their tendency. It is evident from the present demand that the public schools of the future must be more and more democratic, and by that we mean that they must more and more touch closely the every day problems of life. As we view it now the function of the high school is to give a young man a working knowledge of English, history, mathematics and science; and also an opportunity to apply this while in school to some of the fundamental manual occupations. Thus the school on one side will afford what we may call culture; on the other side, training in life's activities. Of these mechanics, agriculture, household economics are fundamental. We are coming to look at these as an important part of public education. It seems strange and terribly wrong that in a democracy this side of public education has been neglected. For two generations provision has been made for secondary training of the liberal sort, training which has benefited only a small minority of the children of the conutry, the sons and daughters of the well-to-do; while the

great majority of children, whose parents could not afford to send them to the high school for a general education, has been driven from the public schools to learn a trade, with difficulty, in the shop or factory. With difficulty, because the apprentice system no longer exists, and industrial institutions are not run with the philanthropic purpose of educating novices.

Most of those who through necessity or choice have acquired a knowledge of bookkeeping, shorthand and typewriting or any other wage earning art, have attained this at their own expense in private institutions. There is a statement made, for the truth of which I do not vouch, that in this year of grace, in the city of Chicago, more boys and girls between the ages of fourteen and eighteen years are attending privately conducted institutions than are attending all of the Chicago public high schools, and that these pay to these private institutions for tuition more money than it costs to support the entire public high school system of Chicago. If this is true, the high schools of Chicago are not common schools in the best sense of that term.

Beyond the elementary school, in the past, education has been provided for the few who least needed it and has left the many who most needed to have that training provided for them, to shift for themselves. As we look at it now, it has been a gross injustice that a poor man should contribute to the maintenance of a costly system of high schools to which he is unable to send his own children, while such schools as they might attend, the state has failed to provide.

I believe that the present high school needs readjustment. If the conditions in which it was created were in existence now it would be ideal. If the present high school could have been placed in the midst of the past generation, the generation with its individualism; its handwork in the home; its family industrial life; its rural community life; its life when hand training was universal and head training occasional; its life when the great mass of workers needed leaders in thought to show them better, quicker, easier and more scientific and efficient ways of doing things; to show them how to shake off some of the drudgery;—the present high school would be the greatest piece of educational work ever constructed by any people at public expense or at any expense; but conditions have changed radically and we have kept on perfecting our high schools from the old academic standard. It is like perfecting a tallow candle or a wagon when the people are using electric lights and flying machines.

The fundamentals of education are the same as they always were. They will be so as long as the human mind exists. The materials and applications of education have changed. Knowledge unapplied or unappliable is not of the greatest value among an industrial people. The three R's are as essential as they always were, but the three R's of today are not the same three R's of a century or a generation ago. Writing as a fundamental past generation R is not of such importance as it used to be. The typewriter,

dictaphone, telephone and telegraph have put it out of business. The adding machine and the multiplying machine are making inroads on the old type of arithmetic; the moving picture, on the old style geography. One language is enough. Speaking generally, there is no use for any other even if acquired.

The high school must know from the beginning to what use its product is to be put. What we call a general education is not of great practical use now a days nor will it be in the future. Hence the idea which the high school possesses now of teaching a little of everything to everybody in a certain and prescribed time needs correction.

Time is a most important element in any kind of a life. A nation must have producers before it can take care of its consumers. The school ought to be the last place for misdirected or squandered time. It must save time by going straight to the point. The zigzag route to a job via foreign language, botany, zoology, chemistry, physiography, physics and general this and general that, is too devious and intricate for the great majority to follow, and more often leads to a world barren and uninhabited except to the leisure class:—it lead directly away from work and the industries. If it be true as some times charged that the high school is educating boys and girls away from manual labor, to look down upon the mechanical trades, and the homely arts of common life, it is unforgivable. The high school, if it keeps its place in the confidence of the people, must aim to turn out a product which will fit into the present social and industrial world. There has been too much refitting necessary in the past. The high school life must be so much a part of the world into which its product is to go that there will be no such thing as a general transplanting or refitting.

The present high school goes on the supposition that a little of everything except industrial work is necessary in order that a person may discover himself. The result is that few are discovered and the waste in readjustment after leaving school is enormous. The school has been turning out a head trained product while the community has demanded a hand trained product with a head to guide it. The school has been training for the profession, law, medicine, teaching and preaching, while the patrons have wanted efficient workmen for business and the industries. The school must turn out people who can produce something or at least be efficient distributors and economic consumers. Any other product must stand around with its hands in its pockets unable to produce because it has not been trained to it, and ultimately to find its way into the economic junk heap.

The school ought to do its utmost to make a fellow choose something by which he can make a living. This can be done only by offering him an education and training leading directly to a definite end, and we have been so afraid that anything with a job attached to it was not cultural that we have headed people away from the modern economical world and not into it. The high school has been entirely bookish, and books at best are only

studies about things, not a study of them. Opinion of the book has been interposed between the pupils and the subject with the result that there is little independent thought on the matter. The book is a bulwark behind which any teacher may hide while she is counterfeiting with the subject. Books are not constructive in themselves and the constructive element is the vital one for high school. For this reason much of the work goes to the waste basket where it belongs. There must be more study of things and less study about things.

The high school has been run almost entirely on the plan that all the students may stay until they graduate, that is, remain four years, no more and no less. The fact is that two-thirds who enter do not complete the course. Some drop out because of necessity in order to make a living for themselves or others. These at least should be allowed to take whatever work they think of value and to do as much of it as possible. Let them concentrate on one definite line and go ahead regardless of the rest of the school. Special classes are necessary and imperative, and teachers who appreciate the situation of these people are equally necessary. Others drop out because of their blindness in some particular study, like Latin or physics or algebra. They have no aptitude for that one particular branch. For those who have no aptitude for anything there is no remedy but to let them go the road that necessity or starvation forces them into. They are the menials of economic society, the hewers of wood and the drawers of water, and as such have their place; but our present plan of forcing those who have a special or even a reasonable aptitude for one line, to take subjects in which they have no interest and no skill, is certain disaster.

I do not advocate letting people choose snaps or quit as soon as a subject presents difficulties, but I do not believe it is good pedagogy or good business to try to make a hound herd sheep or try to make a homing pigeon out of a duck. The pupil with any aptitude should be allowed to develop that aptitude and to develop it with energy.

Any human being is fortunate if he finds and develops his aptitude. To only a few is it ever given to possess more than one, and even to these few the spirit of vacillation as to which talent to use is a handicap. I believe in letting any one take anything as long as he works to a purpose, and that his own purpose. He may take it within regular school hours or outside of school hours under the guidance of the school, just so long as he is in earnest with himself and the subject.

I think we must get away from the rigid course of study, the take all or take none plan. This can be done as soon as we understand that it is the worker and the subject which counts. I do not mean by this that people be allowed to skip promiscuously all over the course until they earn the fifteen credits, or if they do not plan to graduate to loiter awhile over this and that subject.

I do mean that courses of study be adjusted along certain definite and

continuous lines, lines which lead directly somewhere, and that students follow one or another without being compelled to follow something of all. There must be short cuts for the rapid and skillful as well as for those who have but a short time to spend in high school.

The answer to the question, "What shall the high school teach?" is, teach what the community can use and wants to use, and teach it so that it is usable. Lop off everything else. This means fundamentals of an education for all; one line leading to the industries, the things by which the average person makes a living; another line leading to the college and professions. The line leading to the industries must recognize quality as well as quantity. The line leading to the university must recognize quality rather than quantity. This will mean a reversal of our present high school viewpoint. Girls and boys differ in their natures and destinies. Hence the futility of a school which treats them alike, requiring them to take the same type of studies with the result that the training of neither especially fits him for his station in life.

We cannot always tell what line of education is best for a boy because we do not always know what he is to do. We cannot always determine his aptitude. We may educate him for one line and he may choose another. But we need have no such uncertainty about girls. We know what they are going to do. We know what their profession is to be. We know the business that they are going to follow. The great business of their lives, their profession, is to be a housekeeper, the maker and keeper of a home and the mother of children. With this absolute certainty before us, the high school has not always taken much account of the most desirable education for girls. It is urged that domestic science ought to be taught in the home, the mother ought to be the teacher:—granted, but in practice mothers do *not* teach their daughters. Not always do mothers have a knowledge of the underlying sciences, however proficient in the art.

Even in Michigan I believe not enough attention is given to the education that will fit a girl for her job. Forty-five cities out of 109 in Michigan, or practically 50 per cent, have instruction in domestic science. Seven incorporated villages out of 333, or only 2 per cent, report instruction given in domestic science; but only 24 of these 55 cities and 7 of these villages give work in household arts four days in the week. These cities and villages have a total enrollment in the grades of 161,835; a total in high schools of 25,622; a total in the ninth grade of 9,149; a total in the twelfth grade of 3,957.

There graduated last June from these high schools in Michigan 3,384. There are 10,377 girls in Michigan studying Latin, French or German. 9,551 girls study algebra or geometry. The number of girls studying household arts four days in the week is 3,258. One-third as many girls are studying household arts as are studying Latin, French or German; and a little more than one-third as many girls are studying household arts as are

studying algebra or geometry. If I had my way I would have every girl in every high school every day study the science and art of housekeeping and home making.

I do not see how the high school can prepare for industrial life in any other way so effective as industrial training that leads directly toward skilled workmanship and a trade. I quite agree with those who think that the manual training in our high schools must be more definite, that it must get somewhere, that it must add to the earning power, that it must at least point toward a trade. I fear that the whole manual training movement will come into disrepute unless it becomes more practical and more definite. And domestic science which does not center in home making and home management, or lead through the industries to the home, is not worth while.

I would keep the shops, the kitchens and the hand-working rooms and the laboratories open all day and every day but Sunday and for twelve months of the year; book study and recitations in the early part of the day, and shop work in the afternoon. I would have summer sessions largely industrial and vocational. The rural schools must keep going in the summer if they are to teach any real agriculture. Four terms in the year of twelve weeks each: children under fourteen years of age to be allowed to attend only three of these terms; and a voluntary attendance for those above that age, and especially those who are learning a trade, those to whom time is of great importance, those who are physically strong, and those who are preparing for any specific kind of work.

I have not discussed the matter of high school expense. It is great. The per capita cost is not far from three times the per capita cost in the grades. I would not have any less money appropriated for the high school. Indeed, I would have more, but I would distribute it differently,—more for the shops, laboratories and kitchens, even if I had to offer fewer academic subjects.

The university must be given undivided support, for it creates leaders of thought. Leadership is essential. There must be opportunity for investigation and research. The idealist must point the way for the realist, even though the idealist be a rare and costly species. The discovery of the diphtheria antitoxine, antiseptic surgery or any similar discovery once a century justifies the existence of the university. But conditions change for the university as well as for the high school. The university is becoming more and more a professional school and its efforts are along practical lines. It has adjusted itself. It ought to help the high school to adjust itself, and it is a matter of pride that our university in its requirements for admission has recognized the practical work that many high schools are doing. I think it ought to go farther and admit to the arts department a graduate of any high school in Michigan whose superintendent or principal will certify that this graduate is intellectually and morally fit to undertake the work of the University.

Some of the things which, in my judgment, ought to be readjusted, are:

First. Course of study, one route to point toward the university for the few and another route towards industrials for the many. In the college preparatory courses, much of the work now offered beyond the fifteen units should be eliminated; foreign language offered only for those preparing for college, and that simply because the college requires it.

Second. Have fewer academic subjects, fewer sciences, but take these for a longer time.

Third. Do away with the idea that a student, especially a girl, must take subjects for which the student has no aptitude.

Fourth. Provide industrial training for everybody, every day, every boy in the shop and every girl in the kitchen; at least until a pupil is certain that he is to follow the route toward the college, this training to head straight toward a life work.

Fifth. Special trade or continuation schools for those who want a trade, the trades to be taught by a master workman and not by a school teacher.

Sixth. Break the lock-step of graduation. The high school is run on the plan that everybody may or will graduate. For the student who can remain only a year or so the present high school has little to offer. Give any one who is willing to work an opportunity to fit himself for a livelihood in the shortest time possible. This means special classes, graduation in less than four years. It means, perhaps, classes started at irregular times. It means teachers who appreciate the situation.

Seventh. Lengthen school day and week and year. High school students are capable of much work. The long vacation and the short school day tend to create a habit of laziness. The great asset that a young man may bring to his life job is the habit of work. The Russell Sage Foundation has recently published a Comparative Study of Public School Systems in the Forty-eight States. On page 11 you will find this sentence, "As a nation the United States has a shorter school day, a shorter school week, and a shorter school year than any other highly civilized country in the world." But there must be a diversity of work, work for the hand and the mind, so that work will be less like drudgery than now. We must hustle more and hurry less.

Eighth. Fewer books, more laboratories, shops and study of things, and greater emphasis on the constructive side.

Ninth. Less written work, more oral, more public speaking; much less of written work intended for the waste basket.

Tenth. Study of modern English classics as well as of ancient English classics.

Eleventh. Run the school primarily for the great majority who can never go to college. Give the others their fair share of attention, but do not, as now, let their interest dominate the school.

Twelfth. Bear in mind that different types of education are required for boys and for girls.

Thirteenth. Make the school to fit the community and the course of study to fit the pupil.

Fourteenth. Emphasize the idea that the school is a work shop and that there is no substitute for work.

THE PRODUCT OF THE HIGH SCHOOL.

PROFESSOR J. L. MARKLEY, UNIVERSITY OF MICHIGAN.

The Secondary Schools of this country are rapidly undergoing a process of transformation. In fact the change is so great and marked that one might be justified in calling it a process of re-formation. An indication of this change, which is merely a partial illustration, is found in a comparison of the requirements for entrance to the Department of Literature, Science, and the Arts of this University with those of fifty years ago. In 1863, the admission requirements were as follows:

Classical Course.—Arithmetic; Algebra through quadratic equations; English Grammar; Ancient and Modern Geography; Latin Grammar and Exercises; Caesar, Cicero, Six Books of the Aeneid; Greek Grammar and Anabasis.

Scientific Course.—Instead of the Classics, were required 1st, 3rd and 6th Books of Davies' Legendre, and Physics.

The present requirements which went into effect in September, 1912, are as follows:

Applicants for admission as undergraduates must be at least sixteen years of age, and must have completed the requirements for admission as here described. These requirements are stated in units, a unit meaning the equivalent of five recitations a week in one branch of study for one year, amounting in the aggregate to not less than one hundred twenty sixty-minute hours in the clear. Two to three hours of laboratory, drawing, or shop-work will be counted as equivalent to one of recitation.

A. Fifteen units are required for admission. These fifteen units must include three units of English Composition and Literature, two units of a Foreign Language, one unit of Algebra and one of Geometry, and one unit of one of the sciences, Physics, Chemistry, Botany, or Zoology; and may include not more than three units from Group II. They must embrace two subjects of three units each from Group I. It is however, strongly recommended that one or more studies be pursued throughout the four years of the high school course.

The subjects from which choice may be made, and the number of units which will be acepted in each subject, are as follows:

GROUP I.

English Composition and Literature, 4 or 3 units.
Greek, 3 or 2 units.
Latin, 4, 3 or 2 units.
French, 4, 3 or 2 units.
German, 4, 3 or 2 units.
Spanish, 4, 3 or 2 units.
History, 3 or 2 units, or 1 unit.
Algebra, 2 or 1½ units, or 1 unit.
Geometry, 1½ units, or 1 unit.
Trigonometry, ½ unit.
Physics, 1 unit.
Chemistry, 1 unit.
Botany, 1 or ½ unit.
Zoology, 1 or ½ unit.
Physiology, ½ unit.
Geology, ½ unit.
Physiography, 1 or ½ unit.

Three units of science may be offered as a three-unit subject.

In order that a half unit in science may be accepted it must be supplemented by a second half unit in science. For this purpose the only groupings permitted are the following: (a) Botany and Zoology; (b) Zoology (or Botany) and Physiology; (e) Physiography and Geology; (d) Physiography and Botany.

Two units of mathematics and one unit of physics may be offered as a three-unit subject, in which case a second unit of science must be presented.

GROUP II.

Agriculture, 2 units, or 1 unit.
Domestic Science, 2 units, or 1 unit.
Drawing, 1 or ½ unit.
Manual Training, 2 units, or 1 unit.
Commercial Branches, 2 units, or 1 unit.

Subjects from Group II will not be accepted for admission on examination.

B. Graduates of schools on the approved list of the North Central Association of Colleges and Secondary Schools will be admitted upon the presentation of an unqualified recommendation covering not less than fifteen units, of which at least twelve must be from Group I. Admission on this basis of recommendation may be granted also to the graduates of other especially approved schools. Applications for this privilege must be made by the superintendent or principal on special blanks which may be obtained from the Dean of the Department of Literature, Science, and the Arts.

CONDITIONAL ADMISSION.

No applicant will be admitted who presents less than fifteen units. An applicant for admission, either on examination or certificate, who presents fifteen units given in the foregoing lists, but who is deficient in not more than two units in subjects there specified as mandatory, may be admitted conditionally; but any condition thus incurred must be removed at one of the next two regular examinations for admission. No student who has an admission condition outstanding at the beginning of his second year

of residence will be allowed to enter his classes until such condition is removed.

I have said that the comparison is only an indication of the change; for while the main purpose of the Secondary School of fifty years ago was the preparation of boys for college, this phase of the work is but one of the many avowed purposes of the high school of today. In fact, the administrators and supporters of the Secondary Schools long ago reached the point of strenuously and sometimes even bitterly resenting the so-called "domination" of the college over the high school curriculum. I may remark, by way of parenthesis, that I think this feature of the relationship of school and college has been greatly exaggerated, but since it has existed, discussion of the problem must take it into account. And problem it is, whose conditions are becoming ever increasingly more complex, and whose adequate solution seems farther remote than ever before.

The fact that a large number of persons in the country believe that the schools are failing in one respect or another is brought to light by the wide-spread discussion of the inability of our boys and girls, our young men and young women, to do effectively the work which naturally falls to them in the work-a-day world in which they find themselves constituting a part. It may be said, with a considerable degree of justice, that a large part of this discussion is sensational, but one has only to observe his own little field of activity to discover evidences of a real cause for the interest, hostile though it be, in the matter.

It is my purpose to confine myself to my own little field of observation and leave certain aspects of the matter to others who are more competent to discuss it. It will be readily admitted that one legitimate test of a system of education is the measure of its success in fitting its recipients to do their part of the world's work in an effective manner. My subject concerns the ability of the high school graduate to do the work of the college which naturally falls to his lot. I do not come to you with logical proofs, but with impressions which have been formed during twenty-three years of experience in teaching, observing, and advising young men and women, entering for the first time upon college work. During many years of that period, I have been member or chairman of the Committee on Elections whose duty it is to supervise the elections of first-year students.

My impression is, that the average freshman of today is not as well fitted and able to do the work assigned to him and chosen by him, as was the representative of his class twenty or twenty-five years ago. Granting, for the sake of argument, that I am justified in voicing my impression, it may rightly be asserted, by way of accounting for this condition, that there are factors, extraneous to the system of education, which produce this deterioration. Attendance upon high school and college is much more common today than it was twenty-five years ago. Those who attended secondary schools then formed a picked class, made up of sons and daugh-

ters of families in which a college education was either an established or a much desired tradition. That all classes are now embracing higher education, might account for the condition I speak of; the facts, however, will hardly justify the conclusion. If it were possible to divide all our freshmen into an upper and lower class, or even more classes, I think the statement as to fitness would apply to all classes.

Another factor, and one that we are apt to lose sight of, is, that our country and civilization is farther removed from the pioneer stage of development. There seems to be some inspiring element in pioneering which spurs men and women, boys and girls, to make the best of given opportunities, to take every advantage of a favorable condition. If this be true, our educational system has necessarily lost a vigorous, fundamental uplifting impulse.

It may be alleged, also, that our industrial and social life is much more complex than it was twenty-five years ago, and consequently ability to fit effectively into any part or place in it requires a much higher grade of preparation than formerly, and assent to this statement must be readily given. But the educational phase of our changing industrial and social life has kept pace, at least outwardly, with other phases, and from a mechanical point of view, the lack of equipment of the secondary school of today cannot account for the failure described in my hypothesis. There must be some elements inherent in our system of education, our theories, our practices, the tendencies of the times, if you please, which may account for the conditions under consideration.

In the last twenty-five years, a new system of philosophy has been formulated and promulgated. Were I a philosopher, I might attempt to show the influence which this system of philosophy has had on education; or I might attempt to show that the same influences which produced this system of philosophy has brought the change in educational affairs, or perchance I might endeavor to show that a misconception and misapplication of this doctrine has contributed in no small way in producing our present situation. But since I am not a philosopher, I shall not venture on an untried path.

But the people of this age easily and readily accept theories based upon pragmatic hypotheses. The facts of the situation, their bearing on the present condition of the individual and of society have been considered and partially weighed, and practices and theories long and apparently firmly established have been suddenly thrown aside for the new and untried. Your attention is invited to a consideration of one or two of these.

In order to indicate the change of attitude I have reference to, let me give a crude illustration. Years ago, while attending Harvard University, I had the great pleasure of sitting at meals with a group of students interested in many lines of study and research. Among them was a young man who made and is still making philosophy a subject of inquiry. One day while we were discussing, as the young will do, a certain theory of the

universe, I remarked that the facts were not in accord with his theory, to which he confidently replied, "so much the worse for the facts." The reply answered its purpose, for were we not all of us rationalists enough to perceive the drift of his remark? I surmise that today his retort would not be received with the same degree of finality. The most he could do would be to deny the existence of the fact, or at least doubt its existence as conceived in the mind of his opponent.

The change of attitude in regard to "formal" discipline has been most marked in twenty-five years. It has been my lot to take part in the deliberations of the faculty on two occasions of the adoption of requirements for entrance to the Department of Literature, Science, and the Arts. The first time, years ago, the discussions were based on considerations of the comparative importance of studies as to their disciplinary value, and the conviction that somehow or other, one subject should or might be taught so as to be of as great disciplinary value as another, smoothed the way for a settlement of the matter. On the last occasion, a year ago, little mention was made of formal discipline; the discussion followed other lines; not that every one had lost faith in formal discipline, but it was felt that the attitude of the educational world had so shifted that arguments so based would not have sufficient weight to warrant the use of them.

I do not pretend to predict the fate of the doctrine of "formal discipline" nor does it matter much. I do not know if there be such an entity as my memory which can be brought to a higher degree of receptivity and conductivity by certain exercises and practice. It may well be that memory of portions of literature, may not assist memory of dates in history, or memory for faces may not assist memory of names. I leave all these matters to the psychologists. I do believe that a pedagogical misconception of the conclusions of the experimental psychologist may lead to grave results. It is but a step from the acceptance of the psychologic conclusion that there is no such a faculty of mind as the memory which can be developed in general by a particular study, to the belief that the habit of remembering the salient features (which I shall later discuss) of one's experience cannot be cultivated and strengthened.

I know not if there be such an entity as my reason which can be better quickened by the study of mathematics and kindred studies than by the study of language and literature. I leave that also to the psychologist. I do believe that the habit of reaching necessary conclusions can be fostered and strengthened by exercise and care.

There may be no such entity as my judgment, to be better developed by a particular study than by some other study. But the exercise of judging rightly, is the one thing which the world expects of the educated. Training to judgment must remain an important, if not the most important function of the high school. The ability to distinguish the trivial from the essential element in any experience in life even though the former may be more

obvious and insistent than the latter, is what every business man expects of the high school graduate who enters his employ. It is this element of power in the man of thought and action which enables him to give expression to the proper idea, and to follow the proper line of action. Any shift of the pedagogical interpretation of the findings of the psychologists which loses sight of this important fact, cannot but lead to disastrous results.

Let me refer in passing to the doctrine of "interest" about which much has been said and written in recent years, to most of which ready assent can be given. But, as has frequently been urged, there is a point at which interest ceases to contribute in producing desired results. And a misinterpretation and misapplication of the part which interest plays in real education can readily change the practice from an endeavor to interest with a view of engaging the attention, to a determination to amuse and interest with the result of scattering the attention.

Along with this change of attitude in regard to efficiency of formal discipline in theory and practice, and the emphasis of interest as a potent factor in education, has come the adoption of the elective system applied to high school. Whether the change of attitude in regard to the theory led to a change of practice, or the change of practice necessitated a change of theory. I cannot say. It is more probable that both are the result of the forces at work in the evolution of human society. The important thing here is the answer to the question, is there any relation between this change of theory and practice, and the accompanying result embodied in my observation that the product has deteriorated? Our high school graduates may know as much as their predecessors, but have they the same power to do new tasks, and grasp new conditions? I might hesitate to answer this question in the negative, if this inability was detected only in the college class-room; evidence that the same answer would be given elsewhere is not wanting. It is certainly worth while to stop a moment and consider if there is an essential element in the old theory and practice which has been lost in the new.

Has the elective course of study led to the elective attitude of mind, the elective mode of study as a recent writer has designated them? Is there a well-grounded fear that we are dangerously near the point where any real task is unconegnial?

Dr. Julius Sachs in his little book on "American Secondary Schools" by way of clinching his statements in regard to this subject says, "Our contention here is for the fundamental fact that that is no election at all which without knowledge of the content or their service to the thinking efficiency, chooses some subjects and discards others; it is *license,* and produces the usual results of thoughtless action—disappointment, discouragement, waste of opportunities." This, it seems to me is getting near the heart of the matter. I am not condemning the elective system, but endeavoring to point out that consciously or unconsciously, it has developed a wrong attitude. It

seems to have fostered the habit of choosing the agreeable subject without regard to what has been already called "knowledge of their content or their service to the thinking efficiency." And this habit of choosing the agreeable is destructive of manly thought and action. Professor Hinsdale has said, "hard work and plenty of it, and not the passive resignation of the mind to the stream of interest is the condition of thorough scholarship." May I add, hard work and plenty of it, and not the resignation of the mind to the stream of interest is in store for every high school graduate who does what is expected of him; and may I repeat, hard work and plenty of it and not the resignation of the mind to the stream of interest should be the discipline in the preparation for life.

Another great man has put it thus: "training is the discipline that teaches a man to develop the less promising parts of his mind as well as the more promising; to make five talents, ten; and two, five; to see that in his specialty he shall work better and enjoy more for knowing something outside of his specialty; to recognize the connection between present toil and future attainment, so that the hope of the future attainment creates pleasure in present toil; to understand that nothing can be mastered without drudgery, and that drudgery in preparation for service is not only respectable, but beautiful; to be interested in every study, no matter how forbiddding."

I desire to reassert that I am not discountenancing the elective system. It is likely that this has come to stay, and I am not alarmed. What I am trying to emphasize is that, by its nature, and in the process of its adoption, an attitude of mind and a mode of study have been engendered which play counter to a certain essential element of a true education, which was given and fostered by the old system under the old theory. That element is power, power to grasp situations and power to think. And this power can be attained only by performing tasks, disagreeable tasks, if necessary, backed up by a *will to do*.

Again, the shift of emphasis in educational theory and practice has found its expression in the extension of the high school curriculum so as to include "vocational studies" and even to the formation of "vocational schools." And here, also, it is neither my desire nor purpose to decry the movement. I can fully appreciate the idea that an education should assist its recipient in earning a livelihood, and, consequently, a belief has arisen that it is best to know something of many subjects. But he who would make this the sole aim in the education of any class (if such there be) in society, has failed to grasp the fundamental ideals of a democratic state, or even the real significance of the ever increasing demand of society. An education must make a contribution to the ability of the boy or girl, not only in making a living, but also in making life worth living.

Let me give another simple illustration. A short time ago, I had a conversation with one of my colleagues in which he remarked, that of his intimate friends in an engineering class of some twenty years ago, not one of

them had followed the division of engineering practice which he studied in college. Had these young men been educated in a "trade school" they might have had considerable difficulty in adjusting themselves to the changed conditions. Their education had been, however, more a training than a trade. It is interesting to note that the attitude of the business world has changed and is still changing in respect to this phase of education. The belief that specific knowledge is most desirable has given place to the conviction that training to power is the more advantageous.

The popular criticisms referred to in the early part of this paper are based on the very thing I wish to point out. Most employers are desirous that their stenographers be capable of thinking as well as mechanically expert. No accountant can hope to be efficient if he cannot bring to his task a mind trained to think. No labor of any kind can long bring satisfaction and pleasure, if its mere accomplishment is the sole end of doing.

I was speaking to a friend a short time ago in regard to this subject and the way it impresseed me; he intimated that I should suggest a remedy. Time would not permit this, even had I the ability to do it. This is a matter for the educational expert, whose advice should be based on a sound knowledge of the way other peoples have solved similar problems, on a firm grasp of the important conditions involved and a clear vision of the ends to be attained; on a devout regard for methods and practice which have proved to be effective, and with a sympathetic but discriminating regard to popular demands, clamors if you please, which often prove to be fleeting, but more often represent the real call of the age for the remedy to meet an undefined and unfulfilled need of society. My purpose is to point out that, judging from the product of our high schools, while substantial gains have been made, this has been accompanied by certain essential losses, both relatively and absolutely; and that in the process of development, readjustments should be made with the purpose of restoring these losses.

CLASSICAL CONFERENCE

SOME THOUGHTS ABOUT THE VALUE OF THE CLASSICS.

PROFESSOR MORITZ LEVI, UNIVERSITY OF MICHIGAN.

A book entitled "Les Caractèeres" was written by a Frenchman in the seventeenth century. That book begins with a statement which reads somewhat as follows: Everything has been said and he who comes today in order to say something new, arrives too late by more than seven thousand years in which men have lived and thought. Having made that statement, the author proceeds to write a book—a whole book.

On the ancient classics also everything has been said and he who attempts to say something new must be bold indeed. With this brief introductory remark I proceed to repeat some of the old truths with which every schoolboy is or should be acquainted.

But before touching upon my subject proper I wish to say a word regarding the educational ideals which prevail very generally in this country at present. It is that we are passing through a 'stubbly, thistlebearing' epoch. The atmosphere in which we live instead of stimulating that which is greatest and noblest in us seems to choke and stifle us. Every effort of ours is directed towards material prosperity and well-being. Whatever does not somehow or other bring us worldly success is sometimes gently, sometimes rudely, put aside. Such an attitude towards life must necessarily result in neglect of what may be called ideal studies not only by those whose avowed aim it is to seek worldly fortune but also by those, who with the intention of preparing for life, frequent our institutions of learning. And here one may well ask: What does it mean to prepare for life? Surely I do not attempt a new definition when I say that education rightly understood means an all-round development of the human being—a development therefore that deals with the body and mind but one that ought to deal no less with the culture of the heart. It means a development which will make its possessor a valuable and efficient citizen as well as a wise and responsible head of a family. From all this it follows that special education should be put off until the foundation of a general education has been laid. It was Montaigne, I believe, who was the first to lay down what by this time should have become a universal truth, namely that before engaging upon special studies the student should receive a general education which will make him a man. In this connection the writer just quoted relates the following anecdote: "Being once on my journey towards Orléans it was my chance to meet with two masters of arts travelling toward Bordeaux about fifty paces, one from another. Far off behind them, I descried a troop of horsemen, their master riding foremost, who was the Earl of Rochefoucault. One

of my servants inquiring of the first of those masters of arts, what gentleman he was that followed him. Supposing my servant had meant his fellow scholar, for he had not yet seen the Earl's train, answered pleasantly, *He is no gentleman, sir, but a grammarian, and I am a logician.*"

To form a specialist at the earliest moment possible means to narrow the outlook of the young mind instead of widening it. But there are other evil effects following in the train of specialization. Such education forms a nation of individualists, that is, men and women who consider themselves sufficient unto themselves and who cannot enter with any degree of warmth and sympathy into the work of their fellowmen who are engaged in lines other than their own. Now what are the best means toward this all-round education or development? How can we raise the present low standard of general education which obtains in this country? There are certain branches of study upon which the world has practically agreed as being indispensable for a liberal education, such as history and geography, art and literature, science and philosophy. Among these branches literature and art seem to suffer most from neglect. It is said that in 1904 Cornell University had but one student in its Dante course. At the University of Michigan there was one such student in 1911-1912. As to literature, unfortunately, it is too often looked upon as a mere pastime, an amusement, something that vaguely affects the emotions and may be taken up at odd moments and dropped again like a journal with its sensational and motley news. The truth of the matter is that the study of literature is a study of life itself and as such requires the utmost application. A careful reading of a play by Shakespeare, Molière, or Gœthe reveals to us the motives, the passions, the intrigues, the nobility as well as the baseness of human nature. By looking about him the student of literature is surprised at the resemblance of what actually happens in life and what he sees reflected, as in a mirror in every great work of literature. It is a truism that unless a work of literature reveals life, such work had better remain forever on the dusty shelves of our libraries. If such then are the advantages to be derived from great literary works the inference is obvious, namely that the study of literary masterpieces constitutes a most valuable preparation for life. Another advantage to be derived from literature will be seen from what follows: Unless one enters sympathetically upon the study of every character in a play or novel, one finds it impossible to fully understand such work. But this exercise of human sympathy is what is greatly needed by those who are preparing for life. By sympathizing with imaginary characters we learn to enter into sympathy with living beings. As President Wilson has said in his inaugural address: "There has been something crude and heartless and unfeeling in our haste to succeed and be great. Our thought has been "Let every man look out for himself, let every generation look out for itself,' while we reared giant machinery which made it impossible that any but those who stood at the levers of control should have a chance to look out for themselves."

Moreover the proper study of literature cultivates the judgment. Thus for instance the careful analysis of even a single page of a masterpiece is not the task of a child. To pronounce an aesthetic or ethical opinion of value on a literary work is in the highest degree conducive to that mental training which is one of the great aims of all education. To show this latter point somewhat more fully let me recall that some of the greatest minds have been engaged in the business of literary criticism. Is it necessary to mention Aristotle, Horace, the critics of the Renaissance, Goethe, Sainte-Beuve, Brunetière, Faguet, Matthew Arnold? The mental powers displayed by these men in dissecting for the benefit of the student the masterpieces of literature are different, it is true, but they are not inferior to the genius of the men whose work they analyze. The study of literature thus understood then means the training of the mind as well as the education of the heart. We are in need of all kinds of culture, religious, moral, artistic, technical, scientific, economic. Of the cultures mentioned it is that of science which overshadows all the rest. Science makes us acquainted with our surroundings and the world in which we live. We do not complain, therefore, of the devotion to science—what we regret is the neglect of literature which deals with the human soul. Do you realize that when we talk about art and literature—ancient as well as modern—we touch upon some of the vital questions of our own day? We have accomplished the most marvelous material development, but much hard labor and great suffering are still the lot of the multitude. How can some of these burdens be lifted? How can some of the world's wrongs be righted? I have no hesitation in answering, through the cultivation of the feelings, thro' religion, thro' literature and art. Without that education we must forever retain a touch of barbarism and vulgarity. In addition to their aesthetic and ethical value the force of literature has been so great in the past, it has exercised so powerful an influence upon the general evolution of ideas that to neglect it today seems nothing less than sheer madness. It is through literature that some of the greatest revolutions have been brought about in all civilized countries. It is through literature and religion, and art that we have become human.

But what has all this to do with the ancient classics? That is what I shall attempt to bring out in what follows. I have spoken of the value of literature as one of the branches of study that contributes towards developing certain qualities that have been and are still greatly neglected in most schemes of education, I mean the aesthetic sense, the finer sensibilities, including the moral conscience. Now the ancient classics are literature and since by the common consent of those who *know* whereof they speak that literature is among the best the world has produced, it follows that their omission in a scheme of an all-round education cannot but be a serious error. In a discussion of the more particular value of the classics emphasis has been laid upon their numerous uses in the various professions, the disci-

pline to be derived from their study, their aid for a thorough acquisition of the English language thro' derivation and the difficulties to be overcome in translation.

I do not know whether sufficient emphasis has been laid upon the fact that without a knowledge of the ancient classics it is impossible to understand the background of our modern civilization.

As for understanding the great modern English poets without a knowledge of the classics let us hear the opinion of Matthew Arnold. When speaking of the relation of classical to modern poetry he says: "The modern literatures have so grown up under the influence of the literature of Greece and Rome, that the forms, fashions, notions, workings, allusions of that literature have gone deeply into them, and are an indispensable preparation for understanding them;....". And a little further on, the same author continues: "The people are without that preparation; and how much of English literature is, therefore, almost unintelligible to the people .... we can hardly perhaps enough convince ourselves." As a student of Romance languages I have no hesitation in adding this, namely that for the most intelligent study of those languages the ancient classics are indispensible. This holds true more especially with reference to Latin which is the mother of them all. But it often happens that the contents of a literary work written in a Romance language deals with a Greek subject when, for the full understanding of such work, the study of the original becomes essential. As a notable instance of such necessity I should like to point out that for a thorough study and comprehension of the works of Racine, one of the greatest of French writers, the careful perusal of the Greek tragedies is absolutely necessary. In fact if we are to judge by the opinion of that eminent French critic, Emile Faguet, not any *one* Greek tragedy in particular but all of them must be studied by him who would fully grasp the tragedies of the French dramatist mentioned.

After all that has been said there is still to be considered the purely intrinsic value of the classics—that something which we contemplate without a thought of self-interest or gain. This value of the classics may be very far from what is ordinarily styled *practical,* but in reality there cannot be anything more practical than that of which we are most in need in our daily life in order to enable us to lead that ideal life for which we were created by our maker. "I put the poetic and emotional side of literature," says Frederic Harrison, "as the most needed for daily use. I take the books that seek to rouse the imagination, and stir up feeling, touch the heart—the books of art, of fancy, of ideals, such as reflect the delight and aroma of life. And here how does the trivial provided it is the new, that which stares at us in the advertising columns of the day, crowd out the immortal poetry and pathos of the human race, vitiating our taste for those exquisite pieces which are a household word and weakening our mental relish for the eternal works of genius!"

Thus the ideal value of the classics as well of all great literature and art may be considered as the most practical value of all. It is that by which the mind becomes humanized.

A word about the nations whose literature are styled the ancient classics. Carlyle when speaking of the Greeks and Romans says: "There you have the most remarkable race of men in the world set before you to say nothing of the languages which....I believe, are admitted to be the most perfect orders of speech we have yet found to exist among men. And you will find, if you read well, a pair of extremely remarkable nations shining in the records left by themselves as a kind of pillar to light up life in the darkness of the past ages; and it will be well worth your while if you can get into the understanding of what these people were and what they did."

Now if I had sufficient time at my disposal I should mention all the great names that adorn the roll of honor of the Greeks and Romans. I should, moreover, select striking passages from their authors in order to give concrete examples of the thought and sentiment to which they gave expression. I should quote passages like the following: "Old Homer," says Frederic Harrison, "is the very fountain head of pure poetic enjoyment, of all that is spontaneous, simple, native, and dignified in life. He takes us into the ambrosial world of heroes. of human vigor, of purity, of grace, he is the eternal type of the poet In him, alone of the poets, a national life is transfigured, wholly beautiful, complete and happy: where care, doubt, decay are as yet unborn."

I should recall to you the little masterpiece entitled "Oath of the Athenian Youth." "We will never bring disgrace to this, our city, by any act of dishonesty or cowardice, nor ever desert our suffering comrades in the ranks. We will fight for the ideals and sacred things of the city both alone and with many. We will revere and obey the city's laws and do our best to incite a like respect and reverence to those above us who are prone to annul or to set them at naught. We will strive unceasingly to quicken the public's sense of civic duty. Thus, in all these ways, we will transmit this city not only not less, but greater, better, and more beautiful than it was transmitted to us."

And finally I should read to you that splendid tribute paid by Dante to Virgil in his Divine Comedy: "Art thou then that Virgil, and that fountain which pours forth so rich a stream of speech?"....O glory, and light of other poets! May the long zeal avail me, and the great love, that made me search thy volume.

Thou art my master and my author; thou alone art he from whom I took that fair style that has done me honor."

But since I have already taken more time than rightly belongs to me I shall close with one of the most eloquent passages ever penned in praise of the classics. It is by D'Arcy W. Thompson in his *Day Dreams of a Schoolmaster*: "A Dead language: what a sad and solemn expression! Trite

enough, I own; but to a reflective mind, none the less sad and solemn; for in the death of which it speaks are involved deaths untold, innumerable.

I can understand what is meant by "a Dead Sea"; and should suppose it to be a sheet of water cut off from all intercourse with the main ocean; never rising with its flow; never sinking with its ebb; never skimmed by the sail of commerce; never flapped by wing of wandering bird; undisturbed by the bustle of the restless world; but slumbering in a desolate wilderness, far from the track of caravan, or railway, or steamship, in a stagnant, and tide-forgotten and unheeded repose.

But can such a term be applied to that Hellenic speech that in the Iliad has rolled, like the great Father of Waters, its course unhindered down three thousand years: that in Pindar still soars heavenwards, staring at the sun; that rises and falls in Plato with the long, sequacious music of an Aeolian lute; that moves, stately and blackstoled, in Aeschylus, that reverberates with laughter half Olympian in Aristophanes; that pierces with a trumpet-sound in Demosthenes; that smells of crocuses in Theocritus; that chirrups like a balm-cricket, in Anacreon.

Or again, is that old Italian speech dead and gone, that murmurs in Lucretius a ceaseless, solemn monotone of sea-shell sound; that in Virgil flows, like the Eridanus, calmly but majestically through rich lowlands, fringed with tall poplars and rimmed with grassy banks; that quivers to wild strings of passion in Catullus; that wimples like a beck in Ovid; that coos in Tibullus like the turtle; that sparkles in Horace like a well-cut diamond? If these languages be dead, then what language is alive?

MODERN LANGUAGES CONFERENCE

GOTTFRIED KELLER'S *'NOVELLEN'* IN HIGH SCHOOLS.

PROFESSOR J. W. SCHOLL, UNIVERSITY OF MICHIGAN.

Teachers of German do not care to imitate a certain familiar beast
"auf dürrer Heide
Von einem bösen Geist im Kreis herumgeführt"

while "rings umher liegt schöne grüne Weide." Dealing with a living language which is represented by a rich literature, we are not condemned to labor eternally with one fixed program.

Of course our Classic friends, who labor with the first four Books of Caesar, may find in him constant inspiration for twenty years in succession, catch glimpses of new depths of thought in his military reports, new beauties in his description of fortifications, new moral grandeur in his political intriguing, etc., and so be able to serve him up year after year as an appetizing diet for High School students who are trying to build up and confirm some sort of cultural possessions for their future years.

Such geniuses are rare enough, however, even among teachers. In fact, the result is likely to be this. Caesar becomes a *corpus vile* for the same old linguistic dissections, repeated year after year until the teacher is staled and can not impart any enthusiasm to his class. Enthusiasm is contagious. So is indifference, disgust, tedium.

Now, I have begun by mentioning Caesar and our Classic friends, not because anything serious is the matter with either of them when rightly used, but because they are both sadly misused. Monotony is the first station on the road that leads to death. Death is merely perfected *monotony*. And we teachers of modern languages and literatures can die and mummify just as readily as our Classic brethren if we adopt a fixed program of readings.

Grammar teaching will have to remain much the same year after year, but text and materials may be varied from time to time. However, in the literature to be read as an accompaniment to the grammar drill a greater range of choice is offered.

What I wish to plead for here is an avoidance of that "easy descent into Hades" which we all know so well, the fixation of a program, the absolute mastery of it in every detail, which renders fresh preparation for each recitation unnecessary, or worse, not even tempting. We must keep interest fresh by variation from year to year.

I realize that this recommendation carries with it as a possible result—*chaos*. Schools might act individualistically. The teacher in charge might

not always select materials wisely. Their graduates might come to the University with very little in common with graduates of other schools, and interfere with the best success of our classes.

Such considerations are, I believe, relatively negligible. The High School is not a mere feeder of colleges, and it probably ought not be. It is likely to become less and less a normal channel of entrance to college. It seems to me, that a differentiation must be made somehow or somewhere, so that two institutions may grow where but one now flourishes, one for those—the vast majority—who end their education in the High School, another for those few who enter college and university. Until that time comes, our High Schools are primarily finishing schools for our youth, and only secondarily preparatory schools for college.

Accordingly college entrance demands are likely to be ignored, except incidentally, in the arrangement of curricula, and with all due deference to those who differ, we ought not to dictate a policy for the many, for the sake of the few who directly concern us.

If it must be, why, let us have the chaos that may come. The remedy, and a strong corrective it is, lies in training the teacher who is to guide those affairs. An acquaintance with the best literature of Germany, with the German classics, using the word in a larger and better sense than that which limits it to Lessing, Goethe, and Schiller, is a necessary condition for all wise selection of materials.

We have such a flood of texts, some edited well, others not so well, some well worth editing, others not worth editing, many worth close study, others really worthless, that without good training, or good judgment, or both, the responsible teacher is left to sink or swim as best he may, with the aid of such straws or life-preservers in the way of advice and suggestion, which may be thrown out to him by publishers' representatives, fellow teachers, etc.

In this embarrassment of riches, which is piling up month by month, a reliable *Index Expurgatorius* would be helpful, but, for various reasons, teachers shrink from assuming any power of life and death over School Editions, and so we must help one another with our suggestions, and teach by faith that the results will be worth while, if not perfect.

I have come to think that we ought to postpone acquaintance with the so-called classics to a somewhat later date than we usually do in our German courses. There are various reasons for this opinion. Principally, however, the difficulty lies in the unsettling of the pupil's knowledge of syntax and word-values which he has gained in his elementary studies. The reading materials chosen to accompany grammar drill or conversation the first three years in High Schools, possibly longer, ought to be distinctly modern, and conform as nearly as possible to current usage.

There are various German writers of the highest quality, whose works might be used, if properly graded to the stage of advancement of the stu-

dent. Among these are Gottfried Keller, the great Swiss German of the last century, a realist of the best type. If we might extend the term 'classic' to include the best typical writers of the various schools Keller should be recognized as a true German classic.

Some of his works, of course, are not at all adapted to class use. His *'Grüner Heinrich'* is out of the question on account of its length. So is his last great novel *'Martin Salander,'* and I myself would not care to take any of the beautiful stories out of their proper setting in that most remarkable work *'Das Sinngedicht.'* Omitting all these, we still have the two volumes of *Novellen* issued under the title *'Die Leute von Seldwyla,'* the collection of *'Züricher Novellen,'* and *'Sieben Legenden.'*

Six of the *Legenden* are available for class use, the seventh being omitted for obvious reasons, its theme being wholly unsuited to mixed classes of immature students. Of the *Züricher Novellen* one is edited, *Das Fähnlein der Sieben Aufrechten.* Of the delightful group gathered together under the title *'Die Leute von Seldwyla'* quite a number are prepared for schools, namely: *Kleider Machen Leute, Dietegen, Die Drei Gerechten Kammacher, Frau Regel Amrain und Ihr Jüngster,* and *Romeo und Julia auf dem Dorfe.*

Most of these are somewhat difficult, and can find no proper place early in the course. An exception must be made of the *Legenden.* They are rather simple, direct, beautiful narratives, and hold the student's interest. The supernatural element, the intervention of the Virgin Mary at some critical moment, as a substitute for the heroine, is introduced with great skill, and the religious is always completely subordinated to the artistic. One of them, *Die Jungfrau und die Nonne,* is typical. The nun grows weary of her convent life, not because of a dislike for its duties, but because a glance over the walls into the fair world outside awakens a yearning for the fulness of life. She deserts her post. The Virgin assumes her office, her form, and garb, so that her companions do not miss her. Outside the convent a knight in full armor comes riding along. She falls in love with him, becomes his wife, and bears him eight sons. After years of this so-called worldly life, the memory of her claustral life, broken vows, and deserted duty, comes over her with such power that she returns. The Virgin greets her mildly with the words, 'You were gone rather long, my daughter,' restores her office, form, and garb, and no one knows of her adventure, which all would have condemned most harshly. At last a great festival is planned, and all prepare to lay their gifts upon the great altar, save Beatrix, the returned nun, who can make no gift. On the day of the festival, however, the convent is roused by a flourish of trumpets without the walls. An old knight, followed by eight young knights, his sons, are on their way to the Holy Land to rescue the tomb of Christ from the hands of the Infidel. Beatrix recognizes them as her husband and sons, confesses to her

sister nuns the secret adventure, and they all acknowledge that she has brought the greatest gift of all to the altar.

This is typical of the group. They are the work of an artist, not an ascetic or preacher. They are unusually wholesome and humane. Among the others *Eugenia* deserves mention for its beautiful love-story in Keller's very best manner, and *Das Tanzlegendchen* for its hint of a higher ideal than that of classic art or christian asceticism. When the nine Muses (who have been permitted an entrance occasionally) sing at the great festival in heaven, the angels weep with yearning, and a great sigh sweeps through heaven, and even the elders and prophets lose their self-control from memories of the beautiful green earth, and at last the Holy Trinity himself has to come to their rescue and drive the disturbing chorus out of the celestial paradise.

But after all these do not represent the genuine Keller. The true Keller is that of the *Novellen.* He is a successor of Auerbäch, but vastly his superior in every respect.

Auerbach has such a *penchant* for preaching, that he can't paint us a picture or tell us a tale, without placarding the one with moral mottoes and punctuating the other with complacent reflections upon the virtues and vices of the characters. Keller paints us a picture, and lets his characters live before us. Moreover he was a much better and keener and less biassed observer of men than Auerbach. Auerbach's persons are partly embodied ethical formulæ endowed with the powers of speech. Keller's are types of human life with full flesh and blood reality.

The contrast between Auerbach and Keller is that between good and bad art. One has a *Tendenz,* the other is a *Tendenz.* This is a vital distinction, and must be considered in connection with any literature selected for its culture value for school classes.

There is a conflict which is likely to recur in the future as it has occurred in the past. It has usually divided literary critics, and more ordinary readers, into two esthetic camps. The one has for its motto 'art for art's sake,' and will have nothing to do with moral values in literature; the other insists that 'all great art is moral' and demands 'Tendenz' literature as the highest form. The former are still willing to sacrifice content, or tolerate vicious or seductive content, if the form and treatment are esthetically perfect. The latter ignore form in favor of preachment and are likely to tolerate the employment of artistic forms for the sole purpose of making propaganda for some cause.

The simple distinction made above will obviate this whole conflict. True art *is Tendenz* but *has none.* The function of art in the moral sphere is not direct, but indirect, and therefore more powerful. Art creates a picture of some interesting section of life, which is of a nature to appeal to the imagination and feelings of men. Art has a prerogative over nature in this field. Nature can show us life only piecemeal, interrupted, important

things commingled with trivial, all scattered over years perhaps, with no key to its interpretation until long years have revealed the relations between cause and effect, between deed and motive, etc. Art, with a stroke of her magic wand, can crystalize all that into the compass of a hundred pages, and set it, with all its pertinent facts and their connections, with all petty and meaningless elements omitted, before the mind's eye, and let the imagination and the heart of man elaborate it, react to it, assimilate it, reject it, compromise with it, as best they may.

Every work of art so read and appreciated has been truly *experienced.* The reader's *psyche* has been mobilized, quickened, enriched by it. He has acquired some new element of the power to think, feel, and will, has acquired a wider insight into human conduct and affairs, suffering, rejoicing, virtue, guilt, fate, or what not, and has thereby also acquired the basis for a readier sympathy with his fellows. But all this means moral improvement, cultural enlargement, spiritual sensitizing.

I have permitted myself this theoretical excursion, because such considerations ought to have weight in determining the literary materials to be used in classes.

When the language has been learned well enough to permit some appreciation of the content of what is read (and that is the case with classes advanced enough to read Keller's *Novellen*), no student should be given mere trifles to waste time upon. He is entitled to a chance to form a discriminating taste for what is good by experiencing it himself. He is entitled to the benefits of as rich and universal ideal experience as the teacher can put in his way in the brief time allotted to language study. He is entitled to his chance to manifold his own life.

I conceive that a story like *'Romeo and Julia auf dem Dorfe,'* or *'Das Fähnlein der Sieben Aufrechten,'* or *'Frau Regel Amrain und Ihr Jüngster.'* is such a picture of a section of real life, preeminently adapted to stimulate the imagination and feeling to greater and readier activity, while furnishing a body of typical knowledge of human motive and behavior worth remembering and being made a permanent possession to contemplate and to use.

Keller did not intend in *Romeo und Julia* to illustrate or teach the doctrine that one petty wrong done brings with it a train of consequences, which constitute a net in which the doer becomes entangled and which unseen doom-hands clutch and drag until he is completely ruined, yet some such idea is awakened, along with many others. When one has followed the fate of Manz and Marti from their conscienceless theft of an extra furrow from the Black Fiddler's unclaimed intervening field, to the purchase of it by the one neighbor, and the outbreak of the feud; when one has seen both ruined gradually by 'due process of law' and made the scorn and laughing-stock of those who had once respected them; when one sees how the evil spreads like the strands of a malignant cancer into the surrounding whole-

some tissues of society and involves Sali and Vrenchen also, however undeservedly, in the general ruin; one has acquired an insight into moral problems such as no special pleader for a given moral principle could have given.

In *'Das Fähnlein'* it would be hard to formulate any single idea, yet a host of vital impressions of a moral sort are the result of reading it. In *'Frau Regel'* we might say it is the glorification of human efficiency, but that would be a poor way of summing up the value of its study.

It is needless to enlarge upon the culture value of these *Novellen* in the field of ethics.

They owe this quality, as I have said, to their appeal to the imagination.

This appeal to the imagination rests partly upon the plasticity of Keller's thinking. The language is so concrete, suggestive, clear, completely visualizable, that it compels the mind to see objects and situations. Keller's apprenticeship in the art of painting landscapes, his training in seeing things and people as they are in sharp clear outlines, made him a master in literary painting. Take the plowing scene in *Romeo und Julia,* or the children trundling the cart with their fathers' luncheons, or the fishermen posted along the stream that runs past Seldwyla, the return of Frau Regel's seldwylerish husband after she has redeemed his stone-quarry and brought it into a state of efficiency, or the canoeing scenes in *'Das Fähnlein,'* or scores and hundreds of others in these Novellen, and it is certainly a very inert and doughy sort of mind which can escape their power.

Then there is the rich humor. Sometimes it is dry and may escape your notice, and again is is rollicking, and even boisterous, but never out of place. It is never sought after, never the principal thing, never purchased at a sacrifice of better things. Its relation is always that of the vine to the living oak or the solid masonry. The comic efforts of Manz' wife to please her customers, Vrenchen's imposition on the old peasant woman to induce her to take good care of her goods, the drunken capers of Ruckstuhl in the soldier's barracks, in *Das Fähnlein,* and the 'alter Bursch' who at fifty years of age is jostled around and guardianed by his father of eighty, and is willing to get married after being defeated in a test of strength by Carl Hediger, most of the adventures of the 'drei gerechten Kammacher,' and particularly the great race which was to win the hand of Zűs—and incidentally her dower,—all these are typical examples of what I mean.

One might enlarge indefinitely upon these qualities of the content. One might mention the idyllic element, also the rôle which natural scenery plays, and discuss many other things besides, but I will not trespass on your time or patience for them.

As to the language, it has its Swiss flavor, and the vocabulary is enriched by a few local terms, but on the whole it departs but little from the best strain of modern German. We must of course protest against an equation sometimes made, namely, German=Prussian. Keller belongs to Pan-Germany, and is one of its chief ornaments, and an exponent of one

of its best phases. Moreover, his language is free from that very common vice of so much of more recent prose, choppy, tortured and incomplete sentences.

On the whole Keller is deserving of selection in any three or four year High School course, and I should be pleased to see him as generally read and studied by young people as is Theodor Storm.

THE PROBLEMS OF ELEMENTARY WORK IN GERMAN.

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The tendency of this age is toward practical things—the word practical has come to be one of the key-words of the 20th century, and particularly in our own country. This accounts for the elimination of Greek from the large majority of high schools, and also for the decreasing size of the Latin classes, even in our best schools. We teachers, who have grown to love the old classics can not help but grieve over this tendency and in our humble way, we ought certainly to do all we can to help those great scholars throughout the country who are striving so earnestly to arouse greater love and enthusiasm for the master pieces of Greek and Latin literature.

How long will it be before the modern languages will meet with like opposition? That word *modern* has helped to prevent that opposition, I think. How many of our most advanced pupils in High School and College ever have any *practical* use of German and French? Is that primarily the function of foreign language work that the pupil should be able to speak the language? These are questions of great importance to those engaged in the teaching profession.

Just recently I have seen an article written in favor of abolishing the German and French from our schools, unless the method of teaching should be materially changed—it suggested this plan, that in the very lowest grades we should have native German and French teachers for the sole purpose of training the children in the use of the foreign language, at that early age, when they would acquire them so readily. The writer asked what advantage it was for the pupil to be able to read a German story or write German sentences etc. Of course, this was probably written by an extremist, but yet it makes us pause and think, "Why did I study German? Why do I think my pupils should study it?"

Let us consider, then, the course in German offered in the average High School. It consists of two year's work and in the best High School, that must be presented in such a way that it will meet the requirements of our State University which expressly state: "The applicant should be able to pronounce German correctly and should be thoroughly familiar

with the every day facts of the grammar. He should have read about 300-350 pages of standard modern prose and should be able to take part in a simple conservation in German on topics drawn from the works read. He should also be able to translate easy English prose into German."

Of course, we know that the larger number of High School students never go to college, but some standard must be and has been set. Granting this fact, what can we give to a pupil in two year's time? I believe there are three things gained: first a certain training of the mind that cannot be gained so well by any other subject—in memory, in accuracy, in training of eye and ear; second, a better understanding and use of his own language; and third, and to my mind of greatest importance, a knowledge of the German people, customs, and ideals, through their literature. If we could all accomplish that much, I am sure we would be satisfied. Perhaps you, who teach in High Schools, do not have to consider this as much as we do in our preparatory school, where the older men and women cannot understand why language should be an essential entrance requirement.

Now for a more definite consideration of the subject in question—the problems of elementary work in German,—with these aims and ideals in mind. Remember I am considering the two year's course, and I would certainly make a distinction in the elementary work for what we call the "short course" and the "long course" which would mean two more years of work in the High School.

The student who enters a German class for the first time is temporarily "at sea"; in other subjects he seems to see more relation between his previous work and his High School work, such as in History, English, Algebra etc. but in German, the difficulties seem tremendous, as he gazes upon the unfamiliar letters, and hears the unfamiliar sounds. It is as if he were in a new section of the country and we must allow him to become "acclimated" so to speak. For this reason, I believe that the teacher in this early work, should hold the class responsible for no outside work, that the class work should be very simple, a repetition of simple words and phrases, impressing on the pupils the words, first, entirely by sound, then by writing them for him in English letters, then gradually allowing him to see them in printed form. I might say here that it is absolutely essential that a teacher should have a most accurate pronunciation herself; the pronunciation of German cannot be learned by rule, it must be gained by imitation, just as English is. Unfortunately, we teachers who are not German never get the exact German accent, (I believe it is impossible, except through a prolonged residence in Germany), but we can at least pronounce German as well as foreigners who learn English. And we may be sure that any fault in our pronounciation will be repeated in that of the class. I wish that every teacher of German might, in some way, be permitted to spend a few years in Germany.

The question arises here, whether we should use the script in class

work. It seems to me it should be used, if possible, but it is not essential. Most pupils in their teens are pleased to work on this; it is a novelty to them, it appeals to them, but with older pupils, I find it is very often a burden. And at a time when so many of the Germans themselves are changing, I do not believe it should be over-emphasized.

German gender is one of the greatest obstacles in the early work. A pupil may hear "der Tisch" over and over again, but in spite of it, he will say *"die"* or *"das* Tisch," without any hesitation; he feels it is entirely a question of chance. I believe that Germans, who teach German underestimate this difficulty—it is so easy for them, that they are unable to put themselves in the position of the pupil. But we, who had to "grapple with the monster" in our own training ought surely to have sympathy with fellow sufferers. I was speaking of this point once with the head of the German Department in one of the largest and best schools in the state, she herself being a native-born German, and she said that it was a continual surprise to her that pupils at the end of a two year's course in German, could state definitely the gender of one hundred words, which would be neuter in English. When I grow exceedingly discouraged with results in this line, it is always a great consolation to me to recall her words. Perhaps some of you may likewise be cheered. I sometimes try to impress upon a class the fact that they are more fortunate than those who study French, for there is no neuter gender at all, but they usually say, "Well, we could make only one mistake anyway, now we can make two." The fact remains, that we must in some way emphasize the point, for certainly no one who continually hesitates on the matter of gender can either write or speak with ease the simplest German. Of course, repetition of these common words must be made and I find no better way than the reading of a group of easy German stories such as Gűerber's Mărchen and Erzählungen, in which, particularly, in the first group, there is a constant repetition of common words. We must train the eye and the ear.

I have also found one mechanical device helpful—I advise the pupil to take small slips of paper and write on one side the German noun with its article, on the other, the corresponding English. In this way he can, in a very short time, get into one group, the nouns which puzzle him most and by constant drill, gain much accuracy. This same method would hold good for the vocabulary, in general, for the principal parts of verbs etc. The pupil can do a great deal of work by himself in this way, whereas usually he has to study with some one else. It also saves an immense amount of time as I have found by watching different classes.

Then the question arises as to what parts of the grammar are essential, what must be the "stock in trade" of the pupils,—there is a great difference of opinion on this point, among the best German scholars in the country as we can imagine from the variety of the German text books. I have had occasion to consider this matter very seriously in my work, for pupils

come to us from so many high schools in the state at the end of their first year's work, and I often find them way beyond our classes in some respects and wofully deficient in others, this, of course, being due to the difference in our standard text books. It has always seemed fairer to me to consider the two year's work as a unit, for most teachers and books try to accomplish about the same thing in the end. Certainly we would all agree that the ordinary uses of the cases and a thorough knowledge of the verbs and adjectives are essential parts—we might vary on the pronouns.

I think more stress should be placed on the outlining or grouping of nouns, so that the pupil may not feel so helpless. So often he is taught the individual words with their plurals, whereas in most cases he could group dozens of them. For instance, in Thomas's Grammar, we find very few words that could not be classified according to an outline like this:

I. Strong Nouns.
   (1) Mainly polysyllabic masculines and neuters, with two feminines *Mutter* and *Tochter*.
   (2) Mainly monosyllabic masculines with a few monosyllabic feminines and a few neuters. Emphasize *das Jahr*.
   (3) Mainly monosyllabic neuters, no feminines, and a few masculines. Emphasize *der Mann, der Wald*.

II. Weak Nouns.—Mainly polysyllabic feminines with a few masculines and other feminines; no neuters. Emphasize *die Frau, der Knabe, der Mensch, der Herr*.

III. Mixed Declension.
   (1) das Auge; (2) das Bett; (3) das Herz; (4) das Ende.
   (1) der Friede; (2) der Nachbar; (3) der Stadt; (4) der Name; (5) der Vetter.

In this outline, stress hould be placed first on the main headings. A teacher would gain by showing the importance of gender. Let the pupil gain confidence in himself by being able to decide definitely, from the outline, the form of his plural, then gradually other nouns could be added, when necessary. I believe this feeling of confidence means a great deal.

The inflection of adjectives, it seems to me, is rarely acquired by the English speaking pupil, except in a mechanical way. We must give him opportunity after opportunity to use the endings, trying to vary the method of presentation by giving groups of English sentences, in some cases, by giving German sentences with the blanks for adjective terminations, etc. And in this work, I am sure you all meet with the same difficulty—even with students who are German and who come from homes where German is commonly spoken and fairly good German, too. A pupil knows what should be used but doesn't use it. When I hear over and over again when attention is called to a form that is wrong: "Oh yes! That should be so and

so," I feel that I would accomplish better results if I should attempt to teach American parrots who wished to learn German.

With verbs, the difficulties do not seem so great because there is so much similarity in formation of tenses between the English and German. Of course, the use of the auxiliary *sein* will surely cause trouble. I have often seen a pupil who had had three years of German write down "Er hat gekommen," correcting it instantly but showing that his natural tendency would still be the Anglicized German. I think that a great many texts put too much stress on the use of the Passive and Reflexive Verbs, and not enough on the Compound Verb, which is of such vital importance when the student is to deal with the simplest German story.

Included in the verb would come the question of verb order, which is always a difficult point. We find again that same tendency to write the same order as English in spite of all the German verbs the pupil has seen and readily understood. I believe that mechanical work here cannot be overestimated any more than in the adjective and too much emphasis can not be given to this feature. I think too many of our text books trust to the pupil grasping the principle of order very readily. Well—perhaps he does grasp the principle but oh, the practical side of it! This is where the teacher must supplement the text by reviews adapted to the particular needs of the class. Very few of those who write texts, seem to have realized how apt they are to emphasize a certain point in their lessons and then rarely introduce that point in their later lessons. These review exercises of the teacher must be broad enough to connect these broken links into a complete chain and at the same time to supply any deficiency such as I have suggested in relation to the compound verb.

Pronouns must be included to a certain extent in the first year's work but it seems to me that many of the more idiomatic uses could be left untouched. The pupil finds the pronoun hard because English is so weak in this respect and I would like to eliminate as much as possible until the pupil has gained by reading.

In connection with this work, I try to urge the pupil to use a method of study suitable for any language course. I advise him to take a German exercise, which he has already used in class work, translate it into English, then leave it entirely alone for some time and translate back into German. He has thus a check on his work and I think it trains him to ask himself questions instead of waiting for the teacher. If he writes the sentence, "Der Kahn ist an dem Fluss," and finds that it should be "auf dem Fluss," while "Das Haus ist an dem Fluss," I find that it emphasizes the difference in the use of those prepositions better than any explanation I can make. This also helps to fix in mind verb order, adjective inflection, etc. I have tried the method personally in some work in French and find that I impress upon my mind the principles of French very definitely. Of course this seems very mechanical, but yet it has very material results.

In concluding this section on grammar, I might mention that I believe

in presenting the principles of German Grammar in a systematic way. One of the greatest objections to a large number of the more recent publications, is that they give the pupil a vague scattered impression—a little of the verb, here a little, there a little, and so on with the noun, the adjective, etc. The mind of the average high school pupil doesn't need any help in "scattering," he certainly does need it in "systematizing." That is why in spite of many favorable points of the newer texts, I still cling to my Thomas Grammar for the real foundation of my work.

I have often wished that pupils who come into my classes had a more systematic knowledge of English. I do not care how well they speak English, I find that when it comes to a decision of any point in grammar the pupils are exceedingly weak. You have all had pupils who would say "Er ist einen guten Mann," because "Mann" is the object of the sentence,—then ask, which is correct, "It is I" or "It is me"—and they know "It is I" is correct, but why? Now in this foreign language, studied as the average American pupil studies it, without daily association with Germans, it is almost absolutely essential that there should be more systematic knowledge of our own language. Why not have such a course in English Grammar in our eighth grade or in the Freshman year in High School? I can almost hear the prayer of thanksgiving, that would rise from all the Latin teachers and most of the German and French. I notice that one of the topics for discussion in the English Conference now is "What College Freshmen know about English?" Can you imagine what the speaker will say?

But all this grammar discussion makes German sound very technical—perhaps I have put too much time on the discussion of these points. I certainly do not believe that grammar should constitute the entire work, and here I like the large choice of books we may have. I have already referred to Gűerber's book, "Mărchen and Erzählungen," and it is certainly one of the best books for elementary work because, as I have said, it repeats and repeats the common vocabulary, leads up gradually to a broader vocabulary, gives the pupil unconsciously a grasp of word-order, and verb forms that is indispensable. These stories should be read in the German and translated only when absolutely necessary. Then too, it affords the best kind of material for conversational work, which should be employed to as great an extent as is possible for teacher and pupil. This text is edited with questions based upon the stories, and this is helpful for the pupil in preparing his lesson, but I think the class work should be more spontaneous, not simply a repeating of the memorized answers. Here again, the teacher of limited resources must hesitate to attempt conversational work—better no conversation at all than a series of parrot-like recitations. The questions, to begin with, should be exceedingly simple; too often we frighten the pupil by questions involving too much effort. I would rather ask the simplest kind of questions for days, in order to have the pupil gain confidence. The use of common expression like "Wie viel Uhr ist es?" "Wie befinden Sie sich?" etc., appeal to a boy or girl of High School age, and I believe

the teacher often gives a stronger impetus to interest in German, in this way than in any other. There is no question in my mind that this is the best way of developing the language, but it often requires more time than we can devote to it. You can't force conversation, you must lead the pupil to it so gradually that he is unconscious of the effort. Naturally, more of this work can be done in second year German: that is where I believe we teachers should be allowed more freedom in letting conversation take the place of translation and composition, to a greater extent than is now possible.

Now comes the problem of selection for second-year work; the conflict in the mind of the teacher, as to whether she shall give to the pupils the classics, or short stories of minor importance in German literature. In my mind, there is no question, and I have made a test of both methods. Much as I love the classics, much as I would enjoy the enthusiasm of the pupils for the brave Wilhelm Tell, I feel that I have no right to inflict upon them the broader vocabulary, the more complicated sentences of the great poets, when they are still in the elementary stage,— it seems to me like inflicting Shakespeare upon our 5th and 6th grade pupils. So it seems to me better to choose stories, written by our best German authors, such as Storm, Heyse, Baumbach, and others, in which the student comes into contact with typical Germans, can contrast them with his types in English, and in which he gains a general knowledge of German life and customs. We hear a great deal of argument as to the amount of translation, that should be allowed, how much should be expected in the English, etc. The main part is to let the student express himself in grammatical English, keeping as closely to his German idiom as possible. Let the teacher herself be the one who should suggest the better word, the more "finished" translation as we say. I am also in favor of emphasizing in second year work the discussion of the stories read, the study of characters. Are these stories not written for the same purpose as English stories? Many pupils never realize that "Caesar" was not written before Christ, merely as a text book, as we prepare an Algebra or Geometry, and to a certain extent, that is true of German. We must make the Germans real people, we must discuss their characteristics, their manner of expression, etc. "Immensee' is rich in its opportunities—a mere translation of Immensee seems to me a sacrilege— many of you have seen the little "Leit-fragen" prepared by some of the University instructors—they certainly lead to such a discussion and I say where it may be impossible in German, it certainly can always be done in English, I believe the social problems of High School can often be touched upon in this way and much actual good be done.

It probably is unnecessary for me to urge the value of sight translation, at any rate I have consumed too much time and must not do so—it seems commonly accepted as a most valuable aid in our teaching of German.

And now about the composition. In second year work why do we include such a feature? I think we shall all agree that it is for the purpose of

emphasizing the fundamental principles of German Grammar; with the gradual addition of such idioms as seem essential. I have been searching for the best method for several years, and to a certain extent, still feel unsatisfied—I know a great many teachers favor the composition based on the text read, which is included in many editions. Personally, I do not like it for a reason, which I have already hinted at—I want the pupil to read his German stories from the standpoint of literature and fear that he will lose the appreciation of the story itself, if it is connected with the composition, which certainly is not the most agreeable part of the work. When he finishes his work, I want him to have a desire to read more stories, to learn more about the Germans and Germany. I do use the method just at present, but I try to make the composition very simple, dealing with a small vocabulary and emphasizing the principles. I prefer a separate composition book, and have used one until very recently, but I found it based on more advanced work, so I finally decided to change. I have received word, that one of the publishing companies expects to publish a similar book, which deals with a trip to Germany, but adapts its choice of vocabulary and idiom to the needs of more elementary pupils. I am looking forward to it with very great pleasure for that comes nearer to my ideals along this line. Some teachers favor reproduction but this, to me, seems too advanced at this stage.

But along with this actual knowledge of German, that must be at the command of every teacher of German, we must not forget the teacher herself—she can do more in arousing enthusiasm for German, by her personality, than by her actual knowledge. A language teacher usually works under adverse circumstances, because her subjects are considered difficult. A pupil once upon hearing that a certain teacher taught Latin and German, remarked, "Well, then, I bet she's a crank." So it behooves her to place even greater stress on her personal attitude toward the pupil. She must have enthusiasm for her subject, she must be a student of human nature, she must be tactful; above all, she must be a friend of her pupils, must sympathize with them. A teacher, who cannot put herself in the place of her pupils, will never be a successful teacher; her class must be a group of human beings to her, not a group of mechanical objects. In other words, a teacher, herself, must be, not a machine, but a human being, who loves her profession, and means to inspire her pupils with enthusiasm for her subjects, and to give them a broader outlook on life.

In a very simple way, I have tried to tell you of these problems of elementary work in German—they may seem to you very trivial ones, but they are the ones that have come to me in my actual experience. (My problems may differ from those of the average High School because my pupils are much older and have had fewer advantages, educationally). I feel that I have presented very few solutions, so it is with relief, that I look back to my title and see that my subject reads "The *Problems* of Elementary Work in German."

ENGLISH CONFERENCE

PREPARATORY ENGLISH.

PROFESSOR JOHN R. BRUMM, UNIVERSITY OF MICHIGAN.

To the question "What do freshmen know about English when they enter the University?" I might answer no less honestly than briefly that I do not know and that freshmen won't tell. To rest the matter here, however, would be to accept the reward of mere virtue when a greater satisfaction invites—that of exercising the prerogative of omniscience for the fleeting moment during which it may be mine to sit in awful judgment upon the transgressions of my fellow sinners. And it is to a pleasure of this sort that I am about to treat myself. Not that I take personal credit for the seer's vision. The gift is mine by right of succession. I simply accept what many of you, each in his appointed time, have accepted at the hands of a program committee whose chief anxiety is that there shall be no peace among us. You, too, have borne the iniquities of your brethren into the wilderness of pedagogical speculation, only to return again to the blessed commonplace of prosaic endeavor and frequent failure. Presently, I shall take my place among you and share your regret that mortals should not rest content with things as they are in the unlovely, unpretending, familiar, work-a-day heart of them. But for the moment—and let none gainsay me this—the veil has lifted before mine eyes and I have seen the glory of a new day dawn.

It were worth while then to begin at an altitude. Our public school system is the one stupendous failure of modern times. There can be no blinking this fact. *The Ladies' Home Journal* admits the impeachment, *The Woman's World* dare not deny it, and even *The Delineator* is painfully perturbed. Helpless young women are being victimized by our public schools. They have been taught Latin and history and literature and mathematics when they should have been taught how to fry griddle cakes and wash imitation babies. Young men have been robbed of their birthright as boiler-makers and carpenters. And what has been the issue? Neglected homes, underfed husbands, drunkenness, divorce, and suicide, not to mention the recent triumph of the democratic party. Verily the high school is doomed. And in its stead shall be reared that heritage of democracy gone mad, the trade school, where youth may learn the supreme lesson life—how to make a living at the first job that awaits it round the corner on the day of graduation. *E pluribus unum!*

But the great day of democracy's triumph is not yet. Enlightenment seeps but slowly into dullard minds. In the meantime competent mechanic

art and patient domesticity must continue to give precedence to our blind endeavors to make culture and right reason a part of the educational equipment of the graduates of our schools and colleges.

What, then, has been the object of the supposedly systematic training to which we have so long subjected the youth of this nation? To produce the cultivated man and woman, to extend the interests and broaden the sympathies for the widest possible social contact, to develop self-reliance and to inspire devotion, to banish provincialism and the vanity of little minds, to arouse a passion for knowledge and a passion for service—these are some of the phrases into which we compress the educational ideal toward which we are groping. Whether we define an educated man as a man "who does what he ought to do when he ought to do it, whether he wants to do it or not"—President Butler's characterization—or whether we describe our endeavor in schools and colleges as an attempt to develop the "sense for superiority"—to use William James' phrase,—our ideal comprehends a very marked distinction between human skill as an instrumentality and liberal culture as a possession which yields life something beyond mere efficiency. We have long since declared ourselves against the democracy of inferiority and mediocrity, and have striven faithfully to inculcate in our boys and girls a preference for cultural rewards. It is here, I take it, that the issue is raised between our present-day opportunists, who demand practical efficiency, and those conservers of our ancient faith who are true to the quest of perfection.

And it is this popular demand for practical efficiency that is in no small measure responsible for much misdirection and futility in the teaching of high school English. The fault is in the air we breathe. We are being fashioned by economic conditions. On the one hand lies the economic reward that privilege or superior skill may command; on the other lies the goad of economic necessity. All about us are the distractions of noisy achievements. To cherish tranquility of soul, even when there is leisure to do so, is to fall under the suspicion of being un-American. The demand for practicality is growing increasingly insistent. Naturally enough, the utilitarian ideal has invaded the school room, with the result that we are not quite sure of our educational bearings.

We are pretty generally agreed, however, that the purpose of education is to furnish the mind with the widest possible horizon. This endeavor extends beyond the accumulation of facts and conceives of the learning mind as reacting upon these facts in some form of creative activity. Facts are to be seen in relationship, principles are to be derived, inferences are to be drawn. No subject in the curriculum can be isolated as a mere discipline; each must afford its own peculiar contact with life. It is quite obvious, therefore, that the clash between curriculum anarchists and reactionaries rests primarily, not upon the purpose of education, but upon the relative value of the various subjects taught. There can be no doubt that

accurate work, whether performed by the hands or by mental processes, whether it involve the use of carpenter's tools or the appreciation of a poem, is all of a piece so far as training value is concerned. All activity, mental or physical, is a matter of nervous stimulation and adjustment. But it does not follow from this that all subjects are of equal value for the cultivation of constructive imagination. This is true not in the nature of things, but in the nature of conditions. Conceivably, the study of agriculture might be as deeply inspirational in affording a sympathetic appreciation of nature's masterpieces as is the study of literature in its revelations of the human spirit. Likewise any vocational discipline might contribute, under proper conditions, to complete knowledge of life. But the fact is that this reach of potency requires a genius which our training schools for teachers have no immediate prospect of developing.

It appears reasonable to assume, therefore, that literature, and especially English literature, must serve as the chief cultural resource of the secondary schools. It has the primacy for humanity-values, affording, as it does, the most immediate and the greatest variety of contacts with life. Because it not only comprises masterpieces but also the interpretation of masterpieces, it is more wide-ranging in its appeal than any other subject. Clearly, the vocational disciplines are too narrowly circumscribed in their interests to serve this purpose effectually. Science, to be sure, has given wonderful breadth to the intellectual horizon of the nineteenth and twentieth centuries. Scientific inquiry has touched every phase of human thought and activity and has made this world of ours more habitable and life more stimulating and more alluring. We readily concede what John Addington Symonds says of it: that science is the "paramount force of the modern as distinguished from the antique and the mediaeval spirit." It has acquainted us with nature; it has discovered to us the human soul; it has furnished us with powerful socializing agencies; it has transformed and recreated philanthropy, industry, and religion. But this is not the science of elementary study; it belongs to original research, touched by the constructive imagination of genius. As a cultural agency in preparatory schools, science is too seriously limited in its range of achievement to open wide vistas to the immature mind. At best it can give but a promise of greater things to be; it can furnish few immediate contacts with the pulsing life that environs youth.

How, then, has the study of literature measured up to the demands made upon it, or rather to the possibilities open to it? Too often, it need scarcely be said, instruction in literature has taken the form of ingeniously compounded prescriptions which the hapless youth gulps down, sustained by the conviction that he is thus being fortified against the ague of college entrance requirements. More than any one other thing, it is this miserable incentive of preparing students to weather a college entrance test, rather than that of developing a taste for good reading and a creditable command

of thought and expression, that defeats the real purpose of English study. To teach literature solely with the end in view of satisfying college requirements is about as efficacious as attempting to appease the appetite of a healthy boy by storing his mind with a knowledge of food values, in the meantime denying him real food. There can be no doubt that this incentive puts a premium on poor teaching; for it is only the incompetent teacher who will place dependence on the predigested variety of literary pabulum.

Another evil with which we have frequently to contend is the treason practised by school boards in their method of appointing teachers. It is quite possible under the present administration of many of our schools for a specialist in hygiene and botany whose name comes next on the waiting list, to be elected to a vacancy in the English department. "It is this or nothing," sighs the aggrieved specialist, as he proceeds to shape the literary destinies of a half-hundred innocent boys and girls, meanwhile praying devoutly for the early demise of some longevous botanist. Not infrequently the English instructor is a well-tailored young woman who first offered her services as a teacher of Latin or mathematics or history, but who, thanks to taste in dress and the fact that her application for an opportunity to teach her specialty was clothed in impressive English, suddenly finds herself mounted upon a jaded Pegasus whom she immediately subdues into a shambling hack-horse. Well, perhaps it doesn't matter very much after all, for Lester will have made his start in two or three years. Meanwhile, the wanderings of Odysseus and his illustrious warriors may easily be given secure literary anchorage in their geographical setting, thus affording the eager youth something to swear by, and later when he is less cautious—at.

We are asking that the high school graduate be sent to us with a disciplined mind, with some degree of cultivation in taste, and with a measure of spiritual enlightenment. Education, we believe, should bring, first of all, the rewards of culture—culture alike for the youth who must go early into the world as a bread-winner and for the youth who will go to college. But at present culture is on the defensive. The word is used flippantly, as signifying an incapacity to be pleased, effeminacy or dilettantism, supercilious exclusiveness and narrow self-interest. This is not the culture we would seek for our boys and girls, but the culture that comprehends the discipline of sound knowledge, a love for truth and integrity, the abnegation of self in useful service. This conception of culture is in no sense opposed to practical efficency, but its first concern is *not* for material gain. It affords historical perspective and evaluates life in terms of social welfare. It is devoted to the creed that "man cannot live by bread alone" and that truth may be sought for its own sake. It would have us learn how to enjoy greatly and also how to suffer greatly.

Now this "tone," this "sense for superiority," vague though it be in conception, is what we ought to develop in our students through the study of literature. How far our efforts in this direction may prove successful

we can never know completely. There are, however, certain results, largely mechanical in nature, by which we are able to pass judgment upon the student's educational equipment. And it is to this kind of inquiry, as it touches the average freshman's familiarity with literature and command of expression, that I wish to invite brief attention. My conclusions are based upon testimony furnished by the University teachers of literature and of rhetoric.

I shall first present the substance of replies received from the teachers of literature in answer to the question, "What is the character and scope of the average student's knowledge of English literature when he enters upon his University study of the subject?" "He knows," writes one instructor, "pretty much in proportion as he cares, and in more than half the cases that is little. He has more interest, or at least he is more easily interested, in eighteenth and nineteenth century writers than in earlier ones, except possibly Shakespeare. But his knowledge even of recent writers is slight and uncertain." Another writes: "His knowledge is confined for the most part to a few great men; his information is not exact; he has little idea of relation in time, and little or no idea of the relation of literature to history. He places too much reliance upon the idea that English literature is with the language a birthright, and he also has very hazy notions of what is good literature."

Both the teachers of literature and of rhetoric are unanimous in declaring the freshman's knowledge of literature unnecessarily limited, vague, and haphazard. Few instructors find any evidence of real literary acquaintance beyond the prescribed preparatory reading, such acquaintance being confined chiefly to current novels and popular magazines. The George B. McCutcheon-Harold Bell Wright-Laura Jean Libby type of fiction has first place in the literary affections of those students who complain against the dreary grind of their earlier classical reading. It is also generally agreed among University instructors that high school graduates have practically no idea of historical perspective. As one instructor expressed it, "Even though the freshman has studied the essays on Milton and Addison, he is apt to think Macaulay a contemporary of Chaucer."

The freshman's deficiencies in literature may be summarized as (a) a failure to appreciate pure literature, especially poetry, more especially lyric poetry; and (b) a failure to *see* the history of English literature. One instructor points out that the necessity for repeating in college courses much of the high school work is the most serious defect in the whole situation.

Among the remedies porposed for improving the preparatory training in literature are the following: (a) That each pupil be compelled to learn as a matter of course the chronological outlines (not a list of dates, but the succession of periods) of English literature. (b) That history and literature be more closely correlated.

Appreciation of literature, it is quite generally agreed, depends mainly upon the personality of teachers and pupils. The absence of a cultivated

taste, therefore, is often traceable to inefficient teachers, and no less often, perhaps, to a social atmosphere that is wholly alien to any of the arts. There is always the need for better teachers with less work to do, and for a purging of the American spirit in the interest of art appreciation. These, then, are the results as we read them: That very few freshmen have come into vital contact with literature; that their preparatory training, largely mechanical, has done almost nothing to cultivate their taste; and, finally, that the few students who really do love literature acquired their taste, for the most part, in homes where books are cherished in the intimacy of fireside groups.

With reference to preparation in composition the verdict of University instructors is even sadder and more unanimous. The average freshman's incapacity in the matter of structure is characterized in the following comments. One instructor declares that "many students do not even know what a sentence is, and often mistake dependent clauses for sentences." Another says that "from five to forty percent do not know the sentence." Still others accredit the student with knowledge of the very simplest sentence forms, but with almost no command of the rhetorical principles governing sentence organization. Moreover, grammatical defects are prevalent. The paragraph is seldom conceived as an organic unit but rather as a mechanical device, a block of type or script. The chief fault in paragraph organization is incoherence, which may be traced to loose habits of thinking. The organization of the whole composition, unlike the smaller units, may fall naturally into logical thought divisions.

In his command of ideas the average freshman is an uninteresting echo. Never having been taught to respect his own opinions, he exercises every precaution to conceal them from an unfriendly world. His intellectual interests, which are almost negligible, do not touch his real world, but rather the dim, distant realms whither teachers have lured him. His general information is usually irrelevant and inaccurate. He has not been taught to observe attentively nor to think purposefully. He has a positive genius for taking trouble to avoid the necessity of thinking for himself.

The characteristic defects in composition, then, are rhetorical rather than grammatical. Mere approximation to correctness, with little or no regard for effectiveness of presentation, is quite sufficient to satisfy the average freshman. If attention be directed to sentence forms, he will isolate each sentence from its context and examine it merely for correctness of syntax. A succession either of short, crude sentences of the primer variety or of unformed sentences trailing "and's" interminably, presents the only two possibilities available to the majority of students. The abuse and misuse of the conventions of punctuation, devotion to the "dangling participle" (once the student has been cautioned to avoid it), and a failure to employ conjunctions effectively, embrace the major faults in written expression.

A small, commonplace vocabulary, liberally peppered with picturesque slang, is mainly responsible for the defects in diction. In his choice of words

the student seldom has patience for nice distinctions in meanings, never having been trained to exercise care in his spoken and written expression of thought. He is apt to mistake violence for force. He is a strict conformist in matters of taste, being quite willing to accept whatever is agreeable to the person who "grades" his papers.

This, then, is the average freshman as he comes to us to be 'remoulded nearer to our heart's desire.' He knows some one manual of literature indifferently well, which is perhaps as well as most manuals of that sort deserve to be known. Having read the prescribed books as a matter of deadly routine, he sincerely hopes that he is through with the business. He is suspicious of poetry. He is remarkably chary of his own opinions, having grown dependent upon the splendid strength of his literary predecessors. Accordingly, he not infrequently takes cold whenever he gets into a conversational draft at all foreign to his athletic and social activities. He possesses an excellent fund of misinformation. A sheet of blank rhetoric paper spread before him induces mental paralysis, but once this same sheet of paper has been appropriately decorated, the paralysis is transferred to the reader. He writes ineffectively and speaks ineffectively because he thinks ineffectively. For the most part he has received no training in expression outside the English classes. He remembers with sincere affection a choice spirit here and there among his English teachers, and is chivalrously silent about those whom he does not cherish. He lacks discipline, awakened curiosity, and self-acquaintance. He has always been preparing for examinations, and so has never discovered himself or the world he lives in. Since he doesn't intend ever to be a "high-brow prof," he suffers little regret for his aesthetic incompetence. Some day, perhaps, he means to give his aesthetic nature a chance by reading the things he pretended to read in high school. There may be something in them, after all.

It must ever be borne in mind that this average freshman is a difficult person to speak for. In estimating his capacities and capabilities one must depend almost entirely upon impressions gained in the University classrooms. It goes without saying, of course, that there is among this freshman group a goodly number of highly competent individuals. And it is quite probable that the average freshman of to-day is a more cultivated youth than his fellow of yesterday.. It is apparent, at any rate, that real progress has been made here and there among secondary schools. But that there is immediate demand for a more widespread awakening to the real needs of English students there can be no well-founded doubt. I shall here venture to indicate, therefore, what I believe remains to be done in many of our secondary schools before we can rest satisfied that we are meeting our full responsibilities as teachers of English literature and composition. My convictions in this instance are based upon a few *a priori* principles, supplemented by the testimony of more than a hundred college sophomores who gave me the benefit of their own experience in the high school.

I need scarcely remind you that the whole problem is greatly simplified for the teacher whose pupils come to him with a relatively rich social experience to furnish the background of literary study. In the cultivation of taste the home must ever assume leadership. If good books be cherished in the home, if right habits of speech be cultivated in the family group, if something of self-determination grow out of the parental discipline, the teacher may rest assured that his own mind and spirit will present no alien appeal to the boys and girls whose intellectual and emotional quickening has already laid the foundation for true culture. Our problem, however, does not lie with students whose home environment makes for health of mind and spirit, but rather with those whose cultural inheritance is largely barren and frequently perverted. And in our endeavor to touch the inner life of the boys and girls whom we instruct, so that they may adjust themselves to their spiritual environment, we must proceed rationally. This requirement necessitates, on the part of teachers, an appreciation of the various kinds of interest to which appeal may be made during the successive stages of the pupil's development. It demands a more careful discrimination than has hitherto been recognized between what is good literature and what literature is good for the particular stage of development to be served.

Our first consideration, then, will be to determine the dominant interests in each of the four years of high school study. It will be found, I think, that these interests are fairly constant among the various schools and among both boys and girls. Any disturbing influence must be dealt with as it presents itself in individual cases. Once having dicovered the basis of student interest, we shall be able to judge, within reasonable limits at least, what pieces of literature are successively best adapted to meet student needs.

The elements of interest in literature may be roughly divided into *action, character, moral values, style, description as an art form,* and *conceptual relations.* This division comprehends the well-defined stages of mental development,—the preceptual stage, the conceptual stage, and the stage of judgment. Let us see how these interests emerge in the student's experience with literature.

The required reading of the first year in high school usually presents a choice among the following pieces of literature: *Lays of Ancient Rome, The Ancient Mariner, Sir Launfal, Ivanhoe, A Tale of Two Cities, The Sketch Book, Essays of Elia,* Bacon's *Essays,* selections from *Browning, Idylls of the King,* and selections from Palgrave's *Golden Treasury.* The preference for this year is strongly in favor of *Ivanhoe,* with a very slight manifestation of interest in *A Tale of Two Cities.* The poetry read during this year makes almost no appeal as poetry. No beauty is found in *The Ancient Mariner, Idylls of the King,* or the *Golden Treasury.*

It is quite apparent, therefore, that motor images predominate at this

stage of the student's development. Interest centers in action, tales of simple adventure having precedence over stories with complicated plots. A love for the excitement growing out of quick action is responsible for the frequent reading at this time of blood and thunder stories. Boys demand heroic acheivement; girls give preference to struggles for noble ends.

The second year's study usually includes a choice among the following: *De Coverly Papers, Pilgrim's Progress,* Franklin's *Autobiography, The Merchant of Venice, As You Like It, Twelfth Night, Silas Marner, The Vicar of Wakefield, The House of Seven Gables, The Deserted Village,* Palgrave's *Golden Treasury.* First place is accorded to *The Merchant of Venice* and *Silas Marner.* Here the plot interest is still ascendant, though interest in character is given a strong impetus by acquaintance with Shylock and Silas, who make a sympathetic and rather sentimental appeal to the student's imagination. There is no enthusiasm for the *De Coverley Papers, Pilgrim's Progress,* Franklin's *Autobiography.* The *Golden Treasury* claims a few choice spirits during this year. *The Deserted Village* is readily located, but *The Vicar of Wakefield* is considered "too slow," and *The House of Seven Gables* is acceptable only for its plot interest.

The third year usually includes a study of De Quincy, Emerson, Ruskin, and Shakespeare, authors who naturally compel interest in style. It is this year that presents the greatest difficulty to the teachers. The boys and girls have just reached the self-conscious stage that precludes spontaneity from class-room discussions. This very self-consciousness, however, helps to bring forward the soberer interests in literary study. There is at least a dawning appreciation of style and the dramatic elements in literature. De Quincey attains high favor by reason of his felicity and dramatic power. *Julius Caisar* is usually effectively projected against an historical background. When the work of this year is well handled there is some slight appreciation of the different literary types and a general notion of the principles governing organization of thought units. But at no time during the high school course can it be said that interest in style equals the interest in action and character. Figures of speech are commonly ignored, and rhythm and harmony are even more freely neglected. There can be no doubt, however, that this year could readily be made to contribute good effective work in the study of style.

The last year is difficult to analyze, owing largely to the fact that the conduct of the work among the various schools is far from uniform. It is quite apparent, however, that the voluntary reading during the fourth year in high school presents a marked increase in the choice of standard fiction and a corresponding decrease in that of current fiction. Students at this stage manifest a kind of literary conscience. Interest in adventure has given way in large measure to the attraction of personalities and the motives that condition conduct. Moreover, there is a readier response to the dramatic appeal in the world of men and affairs. The first large problems of

life begin to press for solution. Along with all this, there is a growing interest in those graces of style which give promise of the more vital literary response of maturer years.

Looking back over the records of these four years, I find much to regret. It would not be difficult, possibly it would be effective on an occasion of this sort, to wax dithyrambic over the defects in preparatory English. In our criticism of educational matters we have grown quite accustomed to hysteria and subsequent prayer for better things. I have, however, no desire to be either lachrymose or violent. I wish simply to suggest that we still have much to learn. For none of us can close his eyes to the fact that our educational endeavors are meeting with frequent, not to say tragic, failures all along the line. There is much bad teaching and much bad learning. As a consequence there are wasted and perverted powers heaped in pathetic ruins all about us. A college graduate defaults and a bank collapses. Prison doors close behind a man who has enjoyed the very best cultural advantages. What is wrong? Surely this is an easy indictment of our educational practice! "Faulty training!" cries the critic. Perhaps. "Faulty inheritance, then!" amends the critic. More probably. "A bad social and industrial environment!" concludes the critic. More probably still. But it is only crass stupidity that will pretend to isolate any single cause in the complex of circumstances that condition, and motives that eventuate in, human conduct. We are failing miserably as teachers, as fathers and mothers, as citizens, as men and women, else life would be pleasantly ordered for the world. But failure is the inevitable price exacted from those who venture to acheive. We teachers are blind visionaries, but we have not cherished blindness.

What nonsense to ask whether literature can be taught or whether the art of expression can be effectively cultivated! Can mathematics be taught? Not *to* some persons; not *by* some persons. Can history be taught? Not *to* some persons, nor *by* others, any more than being a good husband or a good tight-rope walker can be taught *to* some or *by* others. What is it to think? Thinking is the process by which the new fact of experience is translated in terms of the old. The mind assimilates only what it can shed light upon, only what it has power to illuminate. In this respect it is quite easy to be misled by student accomplishments. We are apt to mistake the memorizing of a fact, or group of facts, for real knowledge. Facts, to be sure, constitute the material of knowledge, but in themselves are valueless, except for exhibition purposes, such as are fostered by certain kinds of examination tests. Unless the mind is able to react upon these facts so as to bring them out of isolation into relationships that create significance, there can be no vital increase in knowledge. How, then, shall the teacher of literature know whether he has touched the springs of impulse, whether he has developed a sense for what is superior, except as he is able to recognize successive stages of growth in the individual lives of his students? Nor

can this recognition be reduced to formulas with which to appraise collective values. Growth in any instance is always conditioned by the life history and not by laboratory deductions based upon the study of ideal types. What can we, who have long enjoyed the wholesome companionship of good books and worthy ideals, say for our own taste beyond a frank acknowledgement that it has moulded by elements of experience largely independent of school-room instruction. And how much of life some of us have had to live before we were accounted worthy to win humble admittance to the fellowship of those whose kingdom is the kingdom of the spirit! We readily command current formulas of literary evaluation and find our security in the conventions of literary taste, but we all know that these formulas and conventions do not touch those deeper sources of truth and inspiration which can never be rendered articulate in expression. Youth also has its treasure store, rich beyond compare, as we should readily perceive were we less blind. We may weigh our pilgrim down with camp equipment, but the success of his pilgrimage will be determined less by the accessories he is able to carry than by the spirit that animates him.

The frequent failures that we all regret are probably the result of those various kinds of unwisdom that belong to the student's inheritance and environment; they are likewise the result of misdirected aims. These latter we may do much to correct by better teaching. The first requisite of good teaching is the good teacher. And the good teacher, I need hardly remind you, is the teacher who finds his way into the inner life of his pupils. He will seek to know, first of all, what life means to them, and then he will earnestly endeavor to meet the possibilities that lie revealed to him. Nor will he want courage to discredit traditional faith when he discovers that faith to be blind. He will find his justification in the conviction that literature belongs to the child and not the child to literature. If he find that he cannot trust his own judgment, he will at least honestly attempt to adapt literature to student interests.

The interests, to review what has already been stated, begin first of all with plot and action. Classic fiction with a strong plot appeal should be given prominence in the earlier part of the high-school course. In most cases it would undoubtedly be wise to discontinue early study of *The Ancient Mariner, Idylls of the King,* Palgrave's *Golden Treasury, Lays of Ancient Rome,* Lamb's and Bacon's *Essays* and the *De Coverley Papers.* The *Sketch Book* may be employed for the study of description and for its plot interest. The leading purpose during this period should be to *develop the reading habit.* Much judicious direction should, therefore, be given to the outside reading.

The second year should take advantage of the increase of interest in character. Franklin's *Autobiography* may be read for this purpose with good results, and Tennyson's *Idylls of the King,* when reserved for this year, affords opportunity for at least a beginning in the study of style.

Lyric poetry, if treated informally, may arouse real enthusiasm at this stage. So long as the teacher is wise enough to avoid the formal essayists, he may, through the use of narrative and character interest, accomplish much in determining the literary preferences of second year pupils. Extensive reading should be encouraged.

Real constructive work in the study of style may be undertaken in the third year. The self-conscious junior, quite willing to take himself and his work seriously, will give earnest thought to literary manner as well as to matter. He may even devote attention to some of the subtleties of style. He is interested in personality as well as in action, and is easily captivated by descriptive elements, harmonious phrasing, and imagery. Diction and organization likewise command his respect, if not his enthusiasm. In a word, junior work offers the best possibilities of the four years of study, though it frequently makes the poorest showing. It requires the very best teaching, for it is at this time that the student's literary conscience begins to assert itself. DeQuincey and Ruskin naturally belong to this period of study. Addison may also captivate the junior, whose philosophy of life does not make too serious demands upon an author's subject matter. The study of Shakespeare and a wide range of poetry should furnish the foundation for the study of literature during this year.

It appears from the reports of students themselves that the four years of high school work in literature may be successfully arranged as follows:

(First year). *Vision of Sir Launfal*—for plot, moral, and descriptive interest; *Ivanhoe*—for all literary appeals, but with the plot interest dominant; *Sketch Book*—for description, plot, and a beginning in character study; Tennyson's *Idylls of the King*—for plot and character. The remaining selections are practically negligible so far as student preferences are concerned. Other selections adapted to the narrative interest should be included in the program.

(Second year). *Merchant of Venice*—for plot primarily, and for character and style secondarily; *Silas Marner* and *The Vicar of Wakefield*—for plot and character; *The House of Seven Gables*—for plot only; *The Vision of Sir Launfal*—for character; and Tennyson's *Idylls of the King*—for a beginning in style. Further choices may well be added.

(Third year). *Joan of Arc*—for style; *English Mail Coach*—for style; *Julius Caesar*—for character primarily, and also for plot and style; *Sesame and Lilies*—for style; Tennyson's *Idylls of the King*—for style; *Silas Marner*—for character; *Lays of Ancient Rome*—for character and plot. As time permits this aesthetic appeal may be extended.

(Fourth year). Emphasis may be put upon character struggle and the technique of style. The lighter forms of the essay and classic drama and fiction should be widely read. The success of this year is determined very largely by the character of the work done during the junior year. At its best it should develop the power of analysis and independent investigation.

I am convinced that more attention should be given to modern novels and to the short story. When the student develops an interest in character and environment he should have his attention directed to epochs and nationalities and localities with which he is more or less familiar. Moreover, the short story will do much toward developing the student's art sense. It is quite needful, at any rate, that his impression of modern life and conditions be fostered by the better kind of books. It ought not to shock college freshmen to learn that there are living men and women who make respectable literary companions even for rather exacting readers. I should like to suggest in this connection that frequent informal reports on outside reading will not only stimulate the reading habit, but improve the character and widen the scope of such reading. The student's pride will urge him to make as good a showing as possible, while the necessity for some fairly definite statement of impression will give purpose to the reading.

I shall conclude this discussion by proposing a plan of study which will, I believe, obviate some of the difficulties and failures in our English study. The details of this plan must necessarily be supplied by the good judgment of the individual teacher, who may readily adapt it to the special needs of his classes.

The plan contemplates a division of English study into three distinct endeavors, or interests, which may be designated by the terms *analysis, appreciation,* and *expression.* The length of time to be devoted to each of these interests, and the relation of each to the others, cannot be arbitrarily predetermined. Indeed the success of the plan depends very largely upon its flexibility. English teachers, above all others, should avoid the deadly routine of an unalterable program.

I. *Analysis* embraces the study of manageable pieces of literature on the formal side and should extend over the four years of the preparatory course. Its purpose is mainly disciplinary. It seeks to enable the student to master a body of facts through an inductive study of good writing.

First of all, it presupposes at each stage of literary development accurate knowledge of such historical facts as furnish the background of literature. It is here that literature and history should be closely correlated. The history of literature is included under this division, not because it will prove serviceable in analysis, but because it may conveniently be combined with this study. Since it is necessary that a student master the chronological outlines of English and American literature—not a list of dates, but a succession of periods dominated by prominent writers—this drill work ought never to be slighted.

Second, it is proposed to give intensive study to literary masterpieces of all types. This study will range through progressive stages, from the more elementary details if simple grammatical forms to the minutiae of rhetorical analysis. It will discriminate between the elements of prose and of poetic style, distinguish literary types, and note literary values. On the

side of structure it will study the details of organization as they apply to the several units of discourse—the sentence, the paragraph, and the whole composition. In all its aspects it affords an inductive study of rhetorical and literary principles. It derives the laws of unity, coherence, and emphasis, and gives careful attention to vocabulary and the various other elements of style. Further than this, it comprehends thought analysis, and affords occasion for the outline, the abstract, and the brief.

Analysis proposes a difficult program. Its purpose is to train students to appreciate workmanship. To this endeavor, therefore, the teacher must bring accurate knowledge and critical skill. He here regards literature as compounded of thought and feeling and technique, all of which he must seek to discover to his pupils.

II. *Appreciation,* the second endeavor, deals more distinctly with the aesthetic side of literary study. It invites students and teachers alike to surrender themselves to literature as a joy, and not as an adjunct to other disciplines. This purpose does not signify a welter of sentimentality, but rather the acceptance of literature as art, and a consequent enjoyment of it in all its intellectual and emotional appeals. Back of the teacher's enjoyment, to be sure, there must ever be the exact information and the critical method that furnish significance to literary appreciation; but these are not here to be thrust forward intrusively as of primary importance. The student is to be given his chance to interpret literature in terms of life, to yield himself to its inspirational power, its wide-ranging imagination, its deep sense of mystery. This means that he shall be encouraged to give free play of his own personality, his caprices and vagaries even, that he may glimpse and finally come to love the beauty and the truth in literature. The quickened heart-beats, the "vital feeling of delight," the deep stirrings of unsatisfied longings—these are the rewards to be sought.

Enthusiasm for literature! Not that there shall be "trailing clouds of glory" without critical landmarks to point the way, but that the student shall taste the flavor of literature for himself. Insight there must be, and judgments to evaluate, but these must grow naturally out of the student's own experience, his own personal impressions. If the preference be for the second or the third best, then there are heights to acheive, new discoveries to seek. Formal rules and lifeless abstractions can never create sensitiveness to beauty or sympathy with life, but sane critical judgments may uncover choicer possessions and afford increased security in present joys.

The point is that literature must be given its chance with our boys and girls. It has too long been hidden by text-book exercises and overweighted commentaries. "During my first three years in high school I despised poetry," writes one of my sophomores. "My experience with it meant dreary hours spent in memorizing dictionary definitions and commentary notes. But on becoming a senior I fell under the spell of a teacher who

loved poetry. 'Listen,' this teacher would say; 'just close your eyes and listen.' And then the majestic organ notes of *Paradise Lost* would possess me, and I knew that poetry was not an inquisition but the highest speech of man."

Here is a hint worthy consideration, especially that of the teacher in the earlier grades. The pupil's listening vocabulary far exceeds his reading vocabulary. Poetry is music. It cannot be trusted to the halting speech of stuttering youth; it must come to him through the ear, which is sensitive to harmony even when lips are dumb. The appreciation of literature, let me repeat, should be kept distinct from the formal analysis. Let there be no painful memories associated with the literature that we wish students to cherish. It should belong to glad moments when a group of persons talked freely together of the things that touched them deeply.

I should like to suggest, in passing, that the popular demand that the literature of youth should interpret the life of youth is misleading. Juvenile literature is too "childish" and immature for most boys and girls of high school age. Except for the Barbour books, *Tom Sawyer, Rebecca of Sunnybrook Farm, Robinson Crusoe,* there is almost no interest in this kind of literature after the ninth grade. The Elsie, Henty, or Alger books are not generally liked. The important consideration is that real literature is for all ages, the choice in any instance being determined by the kind of interest to be sustained. Because a ninth grade boy or girl finds no joy in scanning Dryden's Odes is not to condemn the Odes or the student, but the blindness of a teacher who does not understand the kind of interest that normally belongs to the ninth grade stage of development. It does not take the boys and girls long to find their way into the heroic world of full-grown men and women and commanding events. Literature that feeds the imagination on its romantic side is always acceptable. The youth easily transcends his own experience, after which he wishes to explore the unknown regions beyond. Let this early experience with literature, then, furnish mere glimpse, if that be all that he can command, but do not confine him to the prosaic world that he knows all too intimately.

Nor is it wise, except possibly in the earlier grades, to devote the class-room period to reading. This hour should be given to discussion, to the interchange of opinion, and to the review of choice passages in the text. The reading proper should be done outside of class, the student's interest furnishing the incentive to rapid progress. In this way four or five times as many books may be read as are possible under the old reading-class method.

III. Finally, we are to give attention to *Expression,* the last of our endeavors. Here we have the student as an author; more ambitious, perhaps, than wise, or even interesting, but still the author. His study of literature, and his enjoyment of it, will have inspired the young author with an ambition to acheive heights which nothing but the prudence of old age and

much disillusionment can check. He will wish to write, not of the world he knows so intimately, but of the world of dreams and mysteries, and stirring events. And it is because his imagination outstrips his powers of expression that his written records are naturally incoherent and unfinished. But only the passing years will reconcile him to the world's blindness in not accrediting his genius. It was so with you and with me, dear teacher, and so long as youth sighs

> "For old unhappy far-off things
> And battles long ago,"

it must ever be so. Our problem as teachers is to learn how to render youth articulate without reducing it to the incapacity of a mere sentence machine.

In the first place I recommend that composition be kept fairly distinct from the study of literature. The injunction "Go do thou likewise" can mean nothing but tragedy for either pupil or teacher. Theme work should be closely related to the pupil's own thought-life and personal experience, even though he prefer to follow the gleam of the untravelled road. The temptation to describe the sunrise on the Alps is all but irresistible to the young writer who has never observed the phenomenon. The immediate purpose of composition training, however, is not to teach our boys and girls how to write as the masters of style have written, but to teach them how to express their own thought correctly and with some degree of effectiveness. They must be taught to look into their own soul and write—and then to destroy what they have written and try again, this time correcting a few of their earlier mistakes. Not that the mere avoidance of error should constitute the test of excellence, but that the avoidance of error should be recognized as one of the primary conditions of excellence. Felicity and power of expression cannot be directly imparted, indeed cannot be conciously acquired, but clearness of expression and accuracy of thought may be attained through proper instruction, and these in turn may develop that sense of style which belongs to a rich intellectual and emotional experience. The student who possesses literary taste will come sooner or later to feel the power of some great writer and will unconsciously yield his spirit to that of his master. Until this intuitive sense for effective utterance asserts itself, however, the business of instruction must perform the humble duty of improving the unlovely speech of youth. In this connection, it may be added, the teacher should guard against the evil effects of a purely negative criticism. The indication of error is a very small part of theme-reading. There should be helpful suggestions and actual amendment and correction by the critic. And always the teacher should deal tenderly with this theme-child, for it is the very breath of life to its author. The pupil's creative activity must be entered into with sympathetic understanding, even while the ugly little deformities are being exorcised.

Let it be conceded that we have not achieved a "spotless linguistic and literary millennium" in our heroic endeavor to teach students to use English with purity and propriety. Let it be admitted further that, if the efficacy of composition instruction in schools and colleges be proved only by the great writers it has been able to make to order, our showing is indeed pitiable. These failures, however, need give us little anxiety. Those who find fault with our achievements take their stand on the assumption that composition was offered as a panacea for the ills of Christendom, and that, having failed to produce literary stars of the first magnitude, it should be abolished and an act of Congress passed "forbidding on pain of death anyone under twenty-one years of age to write a sentence." While this recommendation is not without attraction even to the most devoted teacher of composition, it has about it a pedagogical strut that is more picturesque than convincing. It is true that theme-writing is often barren of results; that there is much incompetent criticism of written exercises; and that such inefficient criticism is frequently more harmful than beneficial. It is likewise true that the average student takes to theme-writing about as enthusiastically as he does to a mustard plaster, which has the superior virtue of actually drawing something out of him. But our failures have not been so flagrant as many would have us believe. Considering our aims, we have accomplished much; considering the possibilities open to us, we have left much to be desired.

Unfortunately, we are apt to confuse ability to write with ability to learn, which confusion, as Professor Lounsbury points out, means a failure to discriminate between a "creative act" and an "act of acquisition." Learning to write, necessarily a slow and painful process, depends upon a number of things besides a technical knowledge of the art, chief of these being intellectual growth. But to exclude composition work from our educational endeavor on the ground that fullness of knowledge and clear thinking should precede communication, is to neglect an important psychological truth; namely, that the expression of thought in words is a part of the creative activity that produces thought. That is to say, thought has no vital significance for purposes of communication until we are able to body it forth in words, which in turn react upon the mind, enriching it through suggestion and association. There must be realization of thought before there can be effective expression of thought, but the activity of expression is likewise a condition of the realization of thought. More than that, expression furnishes the incentive that brings thought processes to the fore. When, therefore, we ask the immature youth to write, we do so not because he has important information to impart, but because he must learn how to command his own mental machinery. We are thus teaching him to think as well as to express thought.

The early study of composition should not neglect thorough instruction in grammar and the rudiments of spelling, punctuation, sentence forms.

As the work advances there should be reviews of such portions of the grammar as the faults in composition may render necessary, but this purely mechanical drill, once the composition work is well under way, should be reduced to a minimum. To meet the needs of backward pupils in the upper classes it might be well to conduct delinquent sections, an ever-ready resort in the case of students who are careless or indifferent in their use of English.

Theme-writing should be definitely related to the sources of interest which belong to the successive stages of the student's development. The dramatic interest, therefore, should receive early recognition. The student's social background will determine the character of this appeal. The teacher should ever seek to enable the student to realize his own environment. Children reared in a community where the daily toil of fathers and brothers is daily risk of life, know tragedy at first hand as a brute reality. They should be brought to see it in its spiritual significnce, and thus develop a sense for personal values. The urban youth is quite unimpressed by the sights and sounds that surge about him. He must learn to interpret them. The rural youth must discover the dramatic elements in meadow, stream, and forest. The dramatic instinct is always present; it remains for the teacher to foster and direct it.

This narrative or dramatic interest naturally commands descriptive resources. Action and movement must be projected against a background, and persons and things and events must be portrayed in relationship. The treatment, clearly, must be objective and narrative in its method. But when character values emerge, description becomes expository in purpose, and the young writer begins to generalize. The junior year should emphasize description in its wide range of possibilities. It is at this time that the student tries to set his world in order. He passes judgment upon men and events; he seeks for significance in conduct, and discriminates between relative values. He sees his world in broad-stretching variety.

Exposition and argumentation should receive special emphasis in the senior year. At this time, analysis, synthesis, and inference naturally attain high favor, and while the study of literature is affording insight into literary values, theme-writing should enable the student to organize the facts of his experience into effective expositions and arguments. Along with a knowledge of the elements of prose and poetic style, he should be encouraged to exercise his critical opinion.

In conclusion, permit me to say that I do not believe that the three purposes of English instruction should be formally distributed in the program of study. The time to be given to each will depend upon the peculiar needs of the students. A predetermined number of recitation periods to be devoted to each discipline makes for deadly routine and sure failure. It may be assumed, however, that formal analysis should claim approximately one-fifth of the time during the first two years, and not more than

one-third during the last two years. Literary appreciation should occupy perhaps three-fifths of the recitation periods during the first half of the high school course, and less during the later years, more time being devoted to outside reading as a source of inspiration and cultivation. Composition, carried through the four years, should claim not less than one-fifth of the early study, and should be gradually increased as the student gains experience and command of his powers of expression. The important feature of this plan, I repeat, is its flexibility. The teacher must apportion these several interests as occasion requires.

My recommendations, then, are as follows: that the types of literature studied be adapted to the different stages of mental development; that the early emotional interest be fostered; that much attention be given by the teacher to the pupil's voluntary reading and that this reading be widely extended; that essay reading be reserved for the advanced classes; that the class-room study of poetry in the early years be restricted to epic and dramatic types, but that the teacher take advantage of the pupils' superior listening vocabulary by reading to his classes such lyrics as are easily within their range of appreciation; that students be given more good modern fiction to read and fewer of the incomprehensible masterpieces of classic sanction; that a real effort be made to cultivate literary taste; that the distinct aims in English study be kept reasonably distinct that composition be made to serve the purpose of self-expression and communication, not the trick of feeble imitation. Add to all this my conviction that teachers of English must educate parents to an appreciation of the responsibility of the home in the cultural development of children; that teachers of English must abolish the cheap vaudeville and flashy literature; that teachers of English must have the hearty co-operation of the teachers of other subjects in fostering good speech habits among students; and, finally, that teachers of English should be given first place in heaven—and I rest my case.

PHYSICS AND CHEMISTRY CONFERENCE

THE AMPLITUDE OF VIBRATION, AND THE PRESSURE AND VOLUME CHANGES IN A SOUND WAVE.

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The method of the experiment and computations of this paper may be found in Rayleigh's Theory of Sound, Vol. II, Page 433 f.f., or in Barton's Text Book of Sound, Page 588 f.f.

Sound is a vibratory Phenomenon, propogated by waves which are longitudinal. It is a fair and natural question to ask how far the particles —or layers—of air may move back and forth in any particular wave. I shall try to answer this question in a particular case, and to find also the accompanying pressure and volume changes of the medium. The values obtained, however, will not be actual ones, but will be small members which the true quantities cannot exceed. My numbers will certainly be too large, but they will indicate the order of magnitude of the actual changes in a sound wave.

The general plan of my undertaking is as follows. I shall find the energy per second required to produce a constant sound. Then, from the mass of air holding a known amount of energy, it will be possible to obtain the amplitude of vibration of the particles. From this amplitude I can compute the volume change, and then the corresponding pressure change. The computations which follow are appropriate only in the case of a pure tone. To obtain values for these quantities in the wave due to a fundamental with overtones, or to several sources, would be much more difficult. It will be necessary also—and will cause no appreciable error—to consider the section of the wave dealt with to be plane.

The simple apparatus used to produce the sound consists of a stopped wooden organ pipe connected to a source of compressed air at constant pressure. By means of a glass "T" the air entering the pipe has access to one arm of a U tube holding water—a water manometer. This manometer measures the pressure of the entering air. The volume of air per second may be found by the amount of water displaced when the tube is disconnected from the organ pipe, and held far enough below the surface of water to produce the same manometer reading as the sound required—that is to say by downward displacement of water from any convenient container.

To compute the energy radiated in sound each second it would be necessary to know what fraction of the total energy supplied finally became sound. By basing the computations upon the total energy, I secure values for amplitude etc. larger than the actual values.

An uncertainty no less troublesome than this arises from lack of knowledge of the distribution of sound intensity about the room. Were the source of sound out of doors and upon the ground, and were the ground a perfect reflector, the energy would stream uniformly through the surface of a hemisphere. A whole hemisphere is not available in this room—perhaps only half a hemisphere as the sound first travels away. Also the reflecting power of the walls and floor before me are unknown. So it appears that my hearers will not all hear the same sound, and perhaps none of them just the particular sound to which the figures apply. But I shall consider the energy uniformly distributed over the surface of a hemisphere and shall make computations for a point six meters (6 m) from the source.

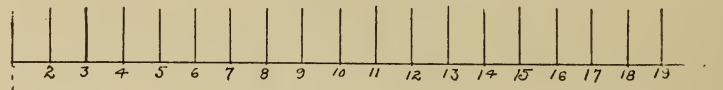

Fig. 1

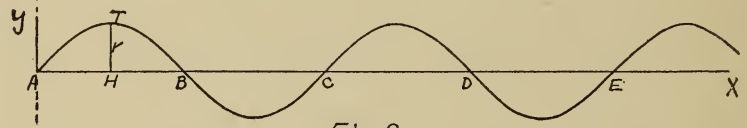

Fig. 2

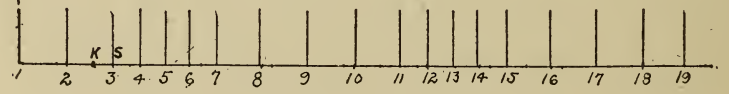

Fig. 3

By comparison with a standard fork the frequency of the tone—the first possible overtone of the pipe—is 780 vibrations per sec. We will let $V = 34000$ cm. per sec. represent the velocity of sound. Since $\lambda = V/N$, the wave length is $34000/780 = 43.55$ cms. The tone I get is very nearly a pure one. Therefore the displacements of the layers of air from their positions of rest may be represented by the ordinates of a sine curve. In figure 1 (P. 13) the lines 1, 2, 3 etc. represent the air layers in their positions of equilibrium. In figure 3 they are shown with displacements proportional to the several ordinates of the sine curve of figure 2. It is seen that layers 5 and 13 are not displaced, and represent the centers of condensations, and that layers 9 and 17 are not displaced and represent the centers of rarefactions. Also any condensation corresponds, not to a crest, but to a region of negative slope along the sine curve,—e. g. from 3 to 8—and a rarefaction corresponds to a region of positive slope—e. g. from 7 to 11. If the curve of figure 2 were detached and could slide bodily with

uniform motion in the positive direction, the appropriate back and forth movements of the layers in figure 3 would represent the behavior of the air in transmitting the plane sound wave of a pure tone. In our case the distance A C, figure 2, is 43.55 cms. We want first to find the distance KS, figure 3, corresponding to HT in figure 2, the amplitude of vibration, which we will call r.

When the pipe is blown with a pressure of 15 cms. of water—the particular value employed—it is found that the volume of air used was 2 liters in 4 secs., or the rate is 500 c.c. per sec.

Then $p = 15 \cdot 1 \cdot 980$ dynes per sq. cm., and the energy supplied per sec. is PV/t or $15 \cdot 980 \cdot 500/1 = 15 \cdot 980 \cdot 500$ ergs. per sec.

Now we consider a sphere whose radius is 6 m, and suppose all the energy flow is distributed uniformly over one half its surface. Then the energy resident at one time in a layer of thickness S over the hemisphere is S/V of the energy sent out per sec., where V is the velocity of sound.

Therefore the energy in the shell at one time is $\frac{S}{34000} \cdot 15 \cdot 980 \cdot 500$ Ergs.

The volume of the shell is $2\pi R^2 S$ C.C. $= 2\pi .600^2 S$
$= 72\pi .10^4 S$ C.C.

Its mass is, of course, volume x density, or $72\pi 10^4 Sd$ grams.

Then the energy per unit mass of the shell is the total energy divided by the mass, or $S \cdot 15 \cdot 980 \cdot 500/34000.72\pi S 10^4 d = 75.98/34.\pi.72.10^4 d$.

Now taking S very small compared to λ (= AC), the energy of the shell is alternately all kinetic as at 5, 9, 13 or 17, and all potential, as at 3, 7, 11 or 15. Since the sum of the energies in the two forms is constant, the maximum kinetic energy (which is accompanied by zero potential energy) equals the total energy. Therefore the total energy of unit mass equals the maximum kinetic, energy $\frac{1}{2}MV^2$, where V is the maximum velocity. Here $M = 1$. Therefore K.E. $= \frac{1}{2}V^2 = 75.98/34.72.\pi.10^4 d$.

Since the air layers have simple harmonic motion the maximum velocity $V_m = 2\pi r/T$ where T is the period and r the amplitude sought, or what is the same thing $V_m = 2\pi rn$, where n is the frequency, 780 vibrations per sec.

Therefore, as above,

$$K E = \tfrac{1}{2} v^2 = \tfrac{1}{2} 4\pi^2 r^2 n^2 = 75 \cdot 98/34 \cdot 72 \cdot 10^4 \pi d$$

from which at once

$$r^2 = 2 \cdot 75 \cdot 98/4\pi^3 \cdot 780^2\, 34 \cdot 72\, 10^4 d$$

Taking *d*, the density of the air, to be 0.001293, or nearly 0.0013 gms. per c.c. we have

$$r^2 = \frac{2 \cdot 75 \cdot 98}{4\pi^3 \cdot 780^2 \cdot 34 \cdot 72 \cdot 13} = \frac{15 \cdot 9.8}{52\pi^3 \cdot 78^2 34 \cdot 72}$$

from which $r = 7.82 \cdot 10^{-5}$ *cm,* or about 8/100000 *of a centimeter,* which is

K S, Fig. 3. This gives the ratio *AB/HT*, figure 2, as $43.5/7.82 \cdot 10^{-5} = 5.57 \cdot 10^{5}$, or about 560000.

It is easy to get from r the value of V_m, the maximum velocity, for $V_m = 2\pi r n = 2\pi\, 7.8 \cdot 10^{-5} \cdot 780 = 0.38$ cms. per sec., or about 0.0085 miles per hour.

It is to be remembered that these are large values for a rather loud sound. Lord Rayleigh estimates that a sound of high frequency might, under favorable circumstances, be audible with an amplitude of $1 \cdot 10^{-8}$ cms. Such figures give one an increased respect for his ears.

The corresponding volume and pressure changes may be found as follows:

Since the wave is plane we may consider a cylinder whose axis coincides with the direction of propogation of the sound. In any section of this cylinder the change in length divided by the original length equals the change in volume of the mass of air divided by its original volume. To get the maximum change consider a cylinder whose axis along $A\,x$ is 0.001 λ. At A the layer is at its position of equilibrium. The equation of the curve is $y = r \sin 2\pi x/\lambda$. Therefore the displacement at $x = 0.001\ \lambda$ is

$y = 0.000078 \sin 2\pi\, 0.001\ \lambda/\lambda$
$= 0.000078\ \pi/500$, since the angle is small. Hence $y = 0.00000049$, which is the change in length. The change in length per unit length is therefore

$$0.00000049/0.001 \cdot 43.55 = 0.00001125 = 11.25 \cdot 10^{-6}.$$

This is also the change in volume per unit volume, or the maximum condensation due to the wave.

To get the pressure change we consider that the conditions are adiabatic. Therefore any transformation takes place according to the equation $PV^r = \text{const.}$, where r is 1.41 for air. This may be written $PV^r = P_0 V_0^r$, or $(P_0 + \Delta P)\ (V_0 - \Delta v)^r = P_0 V_0^r$.

Therefore $(P_0 + \Delta P)/P_0 = V^r{}_0/(V_0 - \Delta V)^r = V^r{}_0/(V_0 - \Delta v)^r$.

Since Δv is very small compared to V (the ratio is $11.25 \cdot 10^{-6}$) we may write $V_0/(V_0 - \Delta v) = (V_0 + \Delta v)/V_0 = 1 + \Delta v/V_0$, from which $1 + \Delta P/P_0 = (1 + \Delta v/V_0)^r = 1 + r\ \Delta v/V_0$ if we neglect terms involving the square and higher powers of $\Delta v/v_0$. Therefore

$\Delta P/P_0 = r\ \Delta v/V_0 = 1.41 \cdot 11.25 \cdot 10^{-6}$
$= 15.8 \cdot 10^{-6}$, the relative pressure change.

If $P_0 = 1012630$ dynes per cm², or one atmosphere,

$\Delta P = 1012630 \cdot 15.8 \cdot 10^{-6}$
$= 16$ dynes per sq. cm., the maximum pressure change due to the wave.

SOME USEFUL LABORATORY DEVICES.

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A Self-filling Barometer.—The apparatus shown in Figure 1 consists of a glass tube one meter long which ends at the lower exeremity in an oblong bulb *B*. The long tube is closed at the top and attached to a meter stick by means of brass clips *D*, *A*, and *C*. The stick is mounted on a pedestal by the screw *A* in such a manner as to turn with considerable friction. A stop is set in the standard at *D*, so that the tube cannot be turned in the wrong direction. By turning the tube to the horizontal position, mercury can be poured into the bulb through the opening *E*. A little tilting of the tube will cause the mercury to run into the long tube until it is completely filled. A small excess of mercury is left in the bulb, so that it prevents any air from entering the long tube when it is restored to the vertical position.

The apparatus is designed for the purpose of permitting the pupil to study fully the barometer principle; for he can rotate the tube until the bulb is uppermost and observe the filling of the tube. He can then slowly restore the tube to the vertical position while observing the formation of the vacuum at the top, precisely as in the Torricellian experiment. Furthermore, the device may be used as a laboratory barometer; for the air will become so completely removed from the tube by tilting it repeatedly that the mecurial column will stand very nearly as high as that of a good barometer.

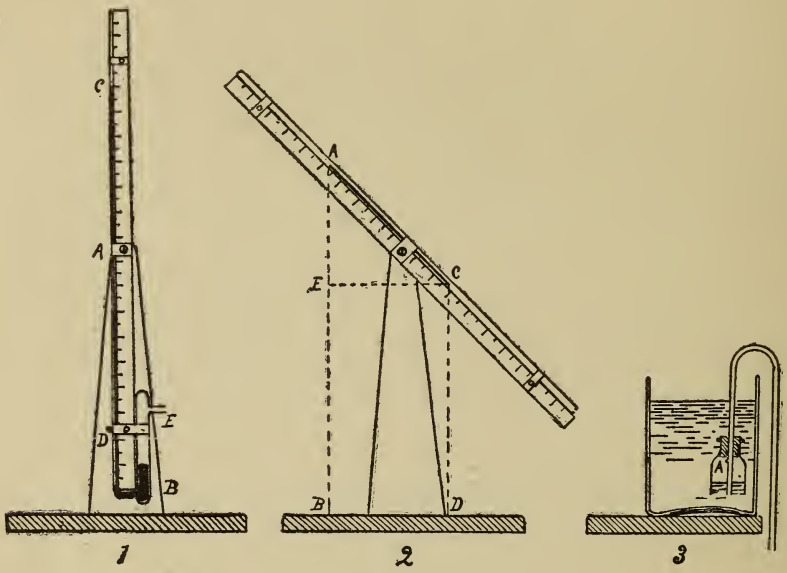
Another important use has been found for the instrument when made in the form shown in the figure. If the opening *E* is connected to an air-pump, the difference in level of the mercury on the two sides of the meter stick shows at once the pressure of the air left in the instument. As a manometer, the apparatus will be found useful in many experiments.

A Simple Mounting for a Boyle's Law Tube.—Figure 2 shows a common barometer tube whose inside diameter does not exceed three millimeters mounted at the side of a meter stick by means of three brass clips. The stick is then attached at its center to a standard, as shown, in such a manner as to turn with friction enough to hold it in any position. A thread of mercury about 30 cm. long is then introduced into the tube to such a point that the enclosed air space is about 35 cm. long. By means of a fine iron (not copper) wire, it will be found that the mercury can beadjusted to any desired position in the tube. Both tube and mercury should be perfectly clean and dry.

In using the device to illustrate Boyle's law, the tube is placed in a horizontal position, and readings are then made to ascertain the length of the air space in the closed end and the length of the thread of mercury. Since the tube is horizontal, the thread of mercury has no influence upon

the pressure of the gas; hence the pressure on the enclosed gas in one atmosphere. In other positions, as the one shown in the figure, the distances *AB* and *CD* are measured and the effective pressure of the thread of mercury *ED* is computed. This amount is then added to, or subtracted from, the atmospheric pressure according as the closed end of the tube is below or above the horizontal line passing through the axis.

A Self-Starting Siphon.—The siphon shown in Fig. 3 was described in a scientific journal a few years ago and has been modified only slightly in this instance. An ordinary glass siphon is provided with a small opening



at *A* about 2 inches from the end. This hole is about the size of a pin. A bottle which has been cut in two at the middle is fitted to the end of the siphon with a rubber stopper as shown. By placing the end of the apparatus in a vessel of water, the liquid begins immediately to flow over the bend and out at the lower end. This is caused by the fact that the compressed air in chamber *A* is driven through the pin hole, thus forming air bubbles in the tube. These bubbles together with the water which is carried along between them pass over the bend in the tube in sufficient number to start the siphon. While the instrument is an interesting curiosity, it will be found useful in removing liquids from battery jars and in other cases of a similar nature.

WHAT THE SCIENCE TEACHER MAY DO TO HELP THE PROHIBITION OF THE ADULTERATION OF FOODS AND DRUGS.

PROFESSOR B. W. PEET, STATE NORMAL COLLEGE.

The conservation of natural resources is a term which is gradually coming to include human life as well as timber and coal. When we are told that nearly one-fifth of the sickness in the world is due to eating poisonous foods, that the consumption of opium in the United States, per capita, has more than doubled within the last forty years, that the consumption of cocain and other habit forming drugs is rapidly increasing and that the general health and efficiency of the human race are rapidly on the decline, we begin to think that a very important problem is before us to solve.

The adulteration of foods and drugs is almost as old as history. Every civilized nation has had to fight it but only within the last decade has it been recognized as a serious problem in the United States. Nearly every state now has a Food and Dairy Department whose business it is to analyze suspected foods and drugs and help protect the people from imposters. The platforms of the Democratic and Progressive parties each contained a plank urging better food and drug laws and President Wilson has many times made public utterances favoring more strict food legislation.

The passage of desirable laws through congress and legislatures is a slow and irksome process, especially when the public is so indifferent and the food and drug adulterators are so clever and go to any expense to sidetrack any legislation that will hurt their business. Publicity is the great lever to force the enactment of needed laws. Articles in magazines and newspapers help, but a campaign of education is needed and is the only way in which the matter will finally be solved.

Where shall we begin? The children in the grades could be taught many things, but the science teachers in our high schools are naturally the ones to interest themselves in the matter and direct the things that should be taught. They could give talks on adulteration of foods and drugs before their classes to begin with. Lecture demonstrations and laboratory experiments by the pupil showing methods of detecting adulteration are always interesting and educational.

The teacher could collect samples of canned goods on the market and teach the student to read the label and at the same time call attention to how the present laws protect us. As an illustration, sodium benzoate is considered by good authorities to be an undesirable and an unnecessary chemical preservative to put in foods, because it enables unscrupulous manufacturers to use decayed and waste fruit. The law allows its use in most

states if so stated on the label. It is possible to buy ketchup and canned goods that do not contain it if one reads the label.

Jello is advertised in nearly every magazine and often in many brilliant colors to attract attention. By using colored powders one is led to believe that he can have strawberry jello one day, raspberry the next and a different fruit each day of the week, but careful reading of the label tells one that the color and flavor are artificial. It is surprising how many housewives use this and really believe they are serving geniune fruit jello. Why not buy the colorless gelatine and add the natural fruits and then have a wholesome article of food? (Show jelly glasses with label.)

The food laws are constantly being violated and attention should be called to the most common cases.

Saccharin is no longer allowed for sweetening foods, yet it is common to find it in soda fountain syrups, ginger ale, orange cider, pop and all soft drinks.

Ice cream in Michigan must contain 12 per cent butter fat and not more than one-half per cent thickening agent.

Hamberg steak is apt to contain sulphites and boric acid, especially during the hot weather. The preserving agent is sold and used under such names as "Freezum" or "Jerusalem" and the meat man will tell you it is used for cleansing, but it is very apt to get into the meat.

If the science teacher would collect samples of these products in his town and make tests before his classes the pupils would soon be educated as to what to buy and the storekeeper would learn to stock his store with pure products. Simple tests for these and many other preservatives and adulterants can be found in the references given at the close of this article.

Every year children are seriously poisoned by eating colored candy and often grown people are indisposed because of eating colored food. Seven aniline dyes are allowed by the government and in most states, but their toxic effect is questionable and as many people have been poisoned eating colored food and as it is unnecessary, I believe in teaching and urging them to leave color schemes out of foods and in warning children not to eat cheap colored candy. An interesting experiment is to extract the coloring matter from candy or cheap jam and show the aniline dye test by coloring white woolen cloth.

We must educate the people and finally our judges as to the seriousness of adultering foods and the selling of foods under a false label though the product itself is not poisonous. Listen to some of the United States court decisions:

Olive Oil found misbranded, fine $25.00.

Lemon Extract—artificial, fine $1.00.

Vinegar misbranded and adulterated—1st fine $10.00; 2nd fine $25.00. Five firms were convicted four times for selling adulterated vinegar and are probably still in the business.

A few years behind the prison bars for a second offense would soon make it less tempting to violate the laws.

Another very serious problem is the drug-forming habit and the misbranding of patent medicines. This should be considered and proper warning given. The Department of Agriculture, Bureau of Chemistry, has a bulletin on the subject.

In every town there is usually an active women's club. A lecture on food adulteration before such an organization could be made intensely interesting and would bring practical results quicker than in any other way.

There is a desire just now to make science teaching more interesting and more practical. Is not here an opportunity to meet this desire and at the same time help in a needful work?

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THE PREPARATION AND PROPERTIES OF PERMANENTLY LIQUID SULFUR TRIOXIDE.

PROFESSOR D. M. LICHTY, UNIVERSITY OF MICHIGAN.

Sulfur trioxide has been known in a more or less pure or anhydrous state since its first preparation by Basil Valentine in the last half of the fifteenth century, by heating ferric sulfate, which yields sulfur trioxide and ferric oxide. Its preparation by heating fuming sulfuric acid was first described by Bernhardt in 1755. For upward of fifteen years or more, it has been made mainly by the contact process from sulfur dioxide and oxygen. All of these processes yield a product which, although possibly at first liquid, becomes at ordinary temperature solid and crystalline, in appearance much like asbestos. This is due to an action of sulfuric acid formed in small quantities by union of sulfur trioxide with moisture from the air.

Sulfur trioxide that is permanently liquid at ordinary temperature, seems to have been first made by Weber at Marburg in 1876, when he sealed the solid form into a tube bent at a right angle at its middle, and subjected it to repeated distillation and to alternate freezing and melting. The portions which did not melt rather readily, were separated from the liquid after each melting, until finally a residue was obtained that melted promptly and remained liquid at room temperature. By distilling the trioxide from phosphoric anhydride, he later prepared the liquid trioxide more easily.

My modification of this method consists in having the rightangled tube end in flasks, which permit the distillation of 100 cubic centimeters or more at a time, and in distilling under a pressure of 20 to 35 millimeters. Potassium sulfate was found to give as good results as the phosphoric anhydride. With the former the traces of sulfuric acid in the trioxide evidently produce potassium hydrogen sulfate, stable at the temperature of distillation (35° or less), while the latter dehydrates the sulfuric acid producing metaphosphoric acid and sulfur trioxide.

The melting point of the permanently liquid sulfur trioxide is 16.8° C. Its boiling point under normal atmospheric pressure is not above 44.9° C. Supercooling to 12 or even to 10° may be necessary before it freezes, and then the whole mass usually becomes crystalline in a moment. Although the critical temperature of sulfur trioxide is at or near 216° C., its coefficient of expansion at ordinary temperatures is 0.0027, *i. e.*, about three-fourths of that of gases (0.00366), and is very high as compared with that of liquids generally. Its density is 1.923 at 20° C. and decreases rapidly (Cf. coefficient of expansion) with rise in temperature, falling to 1.792 at 48° C.

The molecular weight of its vapor is 80, agreeing with the formula SO_3 and also with the molecular weight of the vapor from the ordinary

solid trioxide. In its solution in phosphoryl chloride the depression of the freezing point is such as to lead to the same value for the molecular weight, namely, 80, whether one has dissolved the liquid or the solid trioxide. Oddo has published data which lead to 160 (S_2O_6) as the molecular weight of the solid trioxide when dissolved in phosphoryl chloride. The speaker could not substantiate Oddo's results.

If the purifying apparatus is left in an inverted position, *i. e.,* so that the receiving flask will empty its contents back into the distilling flask, crystals will usually form all over the inner surface of the former, even though the trioxide has been distilled from the anhydride of phosphorus into the receiver twenty times and the walls of the latter have been rinsed off thoroughly after each distillation.

If the trioxide has been distilled from potassium sulfate until it remains liquid at ordinary temperature, and is then left in the receiver, crystals will form in a short time around the potassium sulfate, the quantity growing and the volume of liquid in the receiver decreasing. The crystals seem to form directly from the vapor, and in time all the liquid will have disappeared from the receiving flask and have been converted into crystals in the distilling flask. This change occurs even if the whole apparatus is immersed in a thermostat at constant temperature.

If the wall of a vessel, whose inner surface is moist with sulfur trioxide, is gently warmed, there appears on it a thin coating of crystals which vaporize when warmed more intensely. The first effect is like that of evaporating a solution.

At the sealed off ends of the necks of several vessels in which liquid sulfur trioxide has been enclosed, there appeared after some time small amounts of crystals. In one or two instances, the quantity of crystals grew large enough so that by washing them partly loose by means of the liquid, they extended into the latter but did not appear to increase in quantity. We have here the case of a solid, a liquid and a gas phase existing simultaneously at different temperatures, which is contrary to the phase rule. Evidently these three phases are not related to one another as ice, water and water vapor are, for these can exist side by side at but one temperature.

Before closing, it may be wise to remark that, when distillation is carried out in a sealed apparatus, the heating of the distilling flask and the cooling of the receiver must be so regulated that the internal pressure will not cause an explosion. It is easily possible to cool so efficiently that the material boils well below the temperature required to boil it in air, and that therefore the internal pressure is no source of danger. This method of distilling has been successfully applied both to concentrated sulfuric acid and to mercury.

THE RELATION OF A HIGH SCHOOL SCIENCE TEACHER TO INSTRUCTION IN AGRICULTURE.

PROFESSOR F. S. KEDZIE, MICHIGAN AGRICULTURAL COLLEGE.

It has always been a matter of curiosity to me that the first substances studied by mankind in his efforts to solve the riddle of the universe were the farthest away from him. They were never the materials upon which he could place his hand or those with which he daily came in contact. You need but think of the early discoveries in astronomy and contrast those with the later discoveries in physics to be convinced of the truth of my statement. Little by little our schools begin to believe that what must be taught are those things which one needs to know in everyday life. Professors and school boards flatter themselves that they are the ones who determine what shall be placed in the curriculum of the school, but we now realize that the demands of the public for light to guide their feet is much more weighty than any decision of what shall be taught promulgated by the most learned pedagogue. Yielding as all our schools must to this outside pressure has come latterly the establishment of courses in agriculture in our high schools. These courses of necessity must be elementary, yet in order to be of any worth, viewed from either a practical or pedagogical standpoint, they must be founded on the facts of elementary science which should, so far as possible, be taught in connection with the teaching of agriculture. Knowing this, is the reason that I have selected this topic for review. The science teacher in the high school must put forth decided effort to correlate his subject with the agriculture taught in his school.

At the outset we must recognize that every book on elementary chemistry has so far devoted its attention away from everything looking toward the chemistry of plant and animal life. The reason for this condition of affairs is very obvious to me. It was easier to illustrate the elementary chemical principles by referring to the manufacture of acids, alkalies and metallurgy than to go into the mysteries of the transformations brought about in the surrounding matter by plants and animals and I do not believe now that it will be possible nor advisable in a high school course in chemistry to eliminate much that is now taught in our high school courses, but I do believe that in addition to what is now given,—the pupil should work a certain amount of time with material which will bring him into direct contact with the processes of both growth and development of plants and animals. The easiest way perhaps to make clear my idea is to suggest certain experiments which have an important bearing: First with plants—By experiment prove that in the germination of seeds oxygen must be present. This is readily done by sealing up moistened seeds in glass containers containing various elementary gases such as (a) Hydrogen, (b) Nitrogen, (c)

CO_2, (d) Pure Oxygen, (e) Air. Prove that CO_2 is produced in germination by aspirating air through a bottle containing germinating seeds over into a second bottle containing Limewater or Barium Hydroxide. Prove that Oxygen is produced by leaves growing in sunlight by placing vigorous growing leaves in water charged with CO_2 placed in a flask surrounding the leaves in sunlight. Other interesting experiments that may be tried showing conditions for plant growth are the germination of seeds on pure moistened cotton and after the germination is complete and the plant withers weighing the dried partially developed plant to prove to the student that the seed weighed more than the plant and that germination alone involves loss of weight. These are but mere suggestions illustrative of what may be brought to the attention of the pupil studying plant growth.

The National and State Laws have been educating the people regarding the matter of food but only in a narrow and technical way, however the enforcement of these laws has awakened a deep and widespread interest in the subject of foods in general. Many teachers have seized upon the public interest thus awakened and have created a great deal of enthusiasm among their pupils along the line of detection of food adulteration, the improper use of preservatives, etc. This kind of work does not appeal to me as being at all in the line with the influence which we desire to foster in the school room. It belongs more properly in the police and justice courts. Children are not benefited by having the dishonest methods of some business enterprise exploited. What the children should be given are some basic idea regarding food which belongs to their everyday life and the life of their surroundings.

The human body as well as the bodies of all our domestic animals may be roughly characterized as an internal combustion engine composed of protein which uses carbohydrates and fats as a fuel, and as with all machines there is a constant wearing away of the material of which the machine is made, viz., protein, there must be a steady and continuous supply of this material in addition to the proper amount of energy supplying food ingredients. While the study of protein substances brings us into direct contact with the most complex and as yet least well understood molecules, still on account of its unique relation to animal life and nutrition merits the consideration of every chemistry teacher who aims to give a course that will help his scholar to think whether he becomes a chemist or never again turns his attention in that direction. One of the most difficult subjects for the beginner to grasp is the relation which experience has shown must be maintained between the protein and carbohydrates of a ration, or in other words, the nutritive ratio. This ratio can only be made clear and the elementary beginning knowledge of nutrition be obtained by chemical methods. There must be less talk before our high school scholars and more work done with them of a laboratory character which will give them a definite idea of what protein is and how it is determined. In fact, I believe

that the estimation of the amount of protein material is not so difficult, involving as it does the determination of Nitrogen, but that any high school could undertake the work. The use of the Babcock test bottle has been a revelation to many high school students regarding the subject of what milk is, but if in addition to the work with the Babcock test bottle we took up the matter of the determination of protein in milk and other food substances we could place a great many facts before the student which he could use and would be benefited—when considering the ideas which lead from a protein determination. There is nothing about the Soda Lime method or the Moist Combustion method of Kjeldahl* which cannot be mastered by any high school student and by the use of either of these methods the key which unlocks the mysteries of food and balanced rations is in his hand. The chemistry teacher of the high school can if he will help the teacher of agriculture to the greatest extent if he trains his pupils so that they will

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* Determination of Nitrogen by the Kjeldahl Method (modified).

The Digestion:

Two grams of the material are brushed into a Kjeldahl flask which must be clean and dry. Twenty c.c of C. P. H_2SO_4 are introduced and lastly a piece of cryst. $CuSO_4$ weighing about 2 gms. The flask is then placed on a rack under the draft hood and heated,—no gauze or asbestos being used to support the flask. The heat is applied very gently at first and if the flask froths caution is used to obviate boiling over of the contents. The digestion is completed when the solution becomes clear and light colored. The flask is allowed to cool on the rack to room temperature.

The Distillation:

To receive the amonia gas evolved, 30 c.c of N/5 H_2SO_4 are measured from the acid burrette into an erlenmeyer flask, a little cochineal indicator added and the flask placed beneath the condensing tube leading from the distillation flask.

200 c.c of the tap water is measured out and added to the cooled flask containing the result of your digestion. This solution is then ready to be made alkaline and the distillation started.

Light the lamp on the distillation bench belonging to your distillation flask. Then drop into the flask a piece of mossy zinc, and finally measure out and add 75 to 100 c.c conc. NaOH solution to the flask,—connect immediately to the condenser and shake the flask thoroughly until you are sure the acid and alkali are well mixed.

NOTE: (This "thorough mixing" of the acid liquid and the added strong NaOH solution must not be neglected).

Put the lamp under at once and distil until from 200-250 c.c of distillate has been obtained in your receiving flask.

Stopping the Distillation:

Before removing the lamp always disconnect the flask from the condenser by loosening the cork in the neck of the flask, then turn out the lamp. Next remove receiving flask and find by titration with N/5 alkali how much of the 30 c.c of N/5 H_2SO_4 was neutralized by the NH_3 liberated in your experiment. From this calculate the weight and percent of Nitrogen in the substance. N. X 6.25 = Protein.

NOTES.

(a) Copper Sulfate is used as a transfer agent to carry Oxygen from the H_2SO_4 to the material being digested. The digestion with conc. H_2SO_4 is an oxidation process.

(b) This method for Nitrogen is applicable to all materials containing this element except Nitrates and Nitrites (i. e., oxidized Nitrogen). Bringing a Nitrate in contact with H_2SO_4 would involve loss of Nitrogen on account of escape of HNO_3 vapor.

know by actual personal knowledge what is meant by the term "Protein of the Food."

The longer I teach the more I believe that our greatest mistakes are in attempting to teach too much and the wrong kind of material. Three times a day your scholar is trying the effect of a properly or improperly balanced ration on his body while nothing is offered to him in the laboratory course which gives him the least light regarding the matter. The farmer, when it comes to beef and milk production, says he must know how much protein he is feeding and the answer to his inquiry should be sought from the teacher of chemistry who should enlist the members of his class in attempting the work of testing the food fed by the farmer.

In conclusion therefore I recommend:

1. That the high school science teacher without neglecting the present method of teaching the general principles of chemistry should direct the attention of his pupils to the simplest facts involved in the nutrition of both plants and animals.

2. That the determination of protein quantitatively by the student in a variety of substances used as food for man and animals best opens the way for an understanding of the principles of nutrition.

MATHEMATICAL CONFERENCE

REVOLVING VECTORS

PROFESSOR GEORGE W. PATTERSON, UNIVERSITY OF MICHIGAN

A little more than a century ago a most valuable extension was made in the domain of algebra when Caspar Wessel discovered that direction as well as magnitude might be represented analytically. Text books of algebra have made little use of this discovery though it has been greatly developed in works on the theory of functions of a complex variable, vector analysis and quaternions, and has been extensively used by physicists and electrical engineers. The reason why so little use of this discovery has been made by text books on algebra is not hard to find. Conservatism and the desire to keep general works on algebra within reasonable limits would be a reasonable explanation. However, I venture to address you on the subject, as I believe that anything which makes negative and imaginary numbers more reasonable to high school pupils would be a great gain to the teacher of algebra.

The concept of a vector quantity is primarily geometric, for it requires for expression both magnitude and direction. Evidently a revolving vector has a continuously changing direction while the magnitude may be constant or variable.

Before taking up my main subject, let me turn your attention to negative and complex numbers.

Early in the study of algebra every boy and every girl has the difficult task of mastering the idea of negative numbers, and I fear in many cases the idea is made too difficult to be mastered. Common sense tells us that, in the nature of things, an amount less than nothing is an absurdity. I believe that we all do agree—and must agree—that in actual fact quantities less than nothing at all do not and cannot exist, and that negative numbers or quantities are a conventional way of expressing real and positive things. Let us therefore examine negative and imaginary numbers and quantities with a view to showing their meaning and the uses to which they may be put.

Many quantities are found in pairs, such as debit and credit, up and down, east and west, north and south, along a line and back again, acceleration and retardation, right-handed and left-handed rotation, tension and compression, and others too numerous to mention. In problems involving any one of these quantities we understand a negative answer to indicate not that the answer is absurd, but that the other one of the pair is to be understood.

To illustrate this, let us have the following problem:—The point B is five miles east of A, the point C is ten miles east of A. How many miles is B east of C? We reach the answer that B is -5 miles east of C. The ancients who lived before the invention of negative numbers would probably have declared that the answer denoted the impossibility of the problem, for it is evident that B is not east of C at all. Many pupils beginning algebra would agree in this verdict. The modern explanation is that the negative sign is to be understood as an operator which converts an eastward into a westward sense of measuring distances, and that the point B is found to be five miles *west* of C. Thus we see that we are not required to contemplate a distance of five miles less than nothing, but merely to recognize that east and west are converted into one another by reversal. We thus find a use for negative numbers and thereby save them from relegation to the category of absurdities. It is to be observed that we have thus added a new meaning to the sign minus, previously used for subtraction alone, and also for the sign plus, previously used for addition only.

In the above discussion of negative quantities, it has been noted that the negative sign is an operator which performs the function of reversing the direction or sense in which we count, as from eastward to westward. The result would be meaningless if we were not dealing with one of a pair of oppositely directed quantities. It evidently would be absurd to require

that ten applies be removed from a pile of seven apples, though it is not absurd that a bank should allow a responsible client to draw $1,000 from a credit balance of $700.

It appears then that the words positive and negative cannot well be defined separately and hence should always be defined as a pair and applied to quantities diametrically opposed to one another, equal quantities which when added serve to destroy one another.

Let us now consider roots of negative numbers. The indicated even root of a negative number was for many centuries considered an impossibility and early received the name of an imaginary number. In the strict sense of a number *as used in counting,* such roots are absurd in the same way as negative numbers themselves are absurd. We however have seen that, in connection with associated pairs of quantities, negative numbers have received a useful meaning. It is fair to inquire whether a reasonable meaning may not be found for roots of negative numbers.

Such a meaning was found by Caspar Wessel, a Danish surveyor, and his Memoir on this subject "On the analytical representation of direction" was read before the Royal Academy of Sciences and Letters of Denmark on March 10, 1797 and published in Volume V of the Memoirs of the Academy in 1799. It was republished in French in 1897 by the Academy on the occasion of the centennial of its presentation to the Academy. The Memoir is very interesting and an excellent presentation of the subject. It is very complete; and, had it been known to mathematicians in general, would have saved many years in the development of vector analysis and quaternions. Unfortunately it was put to sleep in the published memoirs, its slumbers not to be disturbed until other more fortunate writers had rediscovered its ideas and published them to the world. Wessel called $\sqrt{-1}$ the sign of perpendicularity.

In brief Wessel recognized that minus one as an operator reverses one of a pair of directed quantities into the other associated quantity, and what was more natural than to assume the reversal takes place by means of a rotation through 180°? If so what would be more natural than to assume that $\sqrt{-1}$ will produce a rotation through 90°, for a second application would be equivalent to a single application of minus one. $\sqrt{-1}$ being a symbol unconnected with numbers used in counting may be endowed with such non-contradictory properties as we see fit. We therefore require that $\sqrt{-1}\ \sqrt{-1} = -1$ when $\sqrt{-1}$ is used as an algebraic factor and as an operator. We thus have an operator $\sqrt{-1}$ which can operate on east to change it into north, a second application changing it to west, a third to south and a fourth back to east again.

Let us apply this new meaning of $\sqrt{-1}$ to a problem. The point B is 10 units east of A, let us find a point P so located that the product of

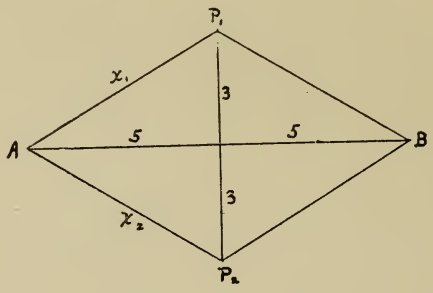
the distances from A to P and from P to B is 34 units. Let the first distance be X and the second 10—X. We then have

$$10X - X^2 = 34.$$

solving the equation and calling these two values of X, X_1, and X_2, we have

$$X_1 = 5 + 3\sqrt{-1} = 5 \text{ east} + 3 \text{ north}$$
$$X_2 = 5 - 3\sqrt{-1} = 5 \text{ east} + 3 \text{ south.}$$

The diagram shows the location of the two points P_1, and P_2 which satisfy the problem. Had the problem been stated to divide a line 10 units



long into segments whose product is 34, we would have said that the problem is impossible for the maximum product possible is 25. The algebraic treatment of the two problems is identical.

Let us now seek for a use for $\sqrt[3]{-1}$ as an operator. Let us as before endow it with the property, both as an operator and as an algebraic factor, that three applications is equivalent to minus one, or

$$\sqrt[3]{-1}\sqrt[3]{-1}\sqrt[3]{-1} = -1$$

Let $X = \sqrt[3]{-1}$

or what is equivalent $X^3 + 1 = 0.$

Indicate the three roots as X_1, X_2 and X_3, we then have

$$X_1 = \tfrac{1}{2} + \tfrac{1}{2}\sqrt{3}\sqrt{-1}$$
$$X_2 = -1$$
$$X_3 = \tfrac{1}{2} - \tfrac{1}{2}\sqrt{3}\sqrt{-1}.$$

Let us apply $\sqrt[3]{-1}$ as an operator to east, we have a choice of results

$$\sqrt[3]{-1} \text{ east} = \tfrac{1}{2} \text{ east} + \tfrac{1}{2}\sqrt{3} \text{ north}$$
$$\sqrt[3]{-1} \text{ east} = \text{west}$$
$$\sqrt[3]{-1} \text{ east} = \tfrac{1}{2} \text{ east} + \tfrac{1}{2}\sqrt{3} \text{ south.}$$

It is evident from the figure that the first value of $\sqrt[3]{-1}$ has rotated east 60° toward north without changing its magnitude, for ½ is the cosine and $\frac{1}{2}\sqrt{3}$ the sine of 60°, and the hypothenuse is equal to unity. The second value rotates east into west through 180° without change in magnitude and the third rotates east through 300° counter clockwise or 60° clock-

wise into the position shown. All on being repeated to the third time produce reversal in direction from east to west.

To avoid ambiguity in the three roots of $\sqrt[3]{-1}$ for which we lack distinguishing signs as for the two roots of $\sqrt{-1}$, i. e. $+\sqrt{-1}$ and $-\sqrt{-1}$, we shall as a rule always understand the operator which produces the smallest counter clockwise rotation.

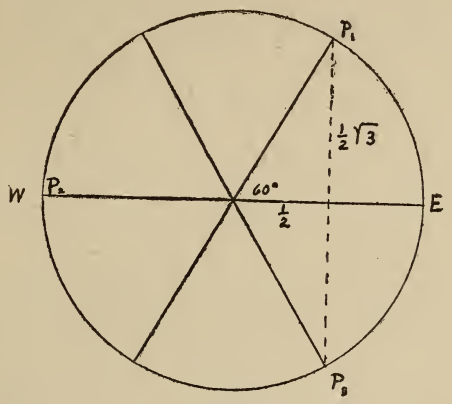


figure 2

We may in a like way investigate the fourth root of minus one. We shall find four values:

$$X_1 = \tfrac{1}{2}\sqrt{2} + \tfrac{1}{2}\sqrt{2}\,\sqrt{-1}$$
$$X_2 = -\tfrac{1}{2}\sqrt{2} + \tfrac{1}{2}\sqrt{2}\,\sqrt{-1}$$
$$X_3 = -\tfrac{1}{2}\sqrt{2} - \tfrac{1}{2}\sqrt{2}\,\sqrt{-1}$$
$$X_4 = \tfrac{1}{2}\sqrt{2} - \tfrac{1}{2}\sqrt{2}\,\sqrt{-1}.$$

As both the sine and cosine of 45° are $\frac{1}{2}\sqrt{2}$, we see that X_1, as an operator converts east into northeast without change in magnitude. The others convert east to northwest, southwest and southeast; and all on being repeated to the fourth time produce reversal. As before let us understand $\sqrt[4]{-1}$ as an operator rotating through the least angle 45°.

It is easily proved that all roots of minus one have this rotational property, and in general that

$$\sqrt[n]{-1} = \cos \pi/n + \sqrt{-1} \sin \pi/n$$

for the root of smallest rotating power. The roots are given by the general formula

$$\sqrt[n]{-1} = \cos \frac{(2m+1)\pi}{n} + \sqrt{-1} \sin \frac{(2m+1)\pi}{n}$$

in which m is zero or any whole number.

It is interesting to know, though the time at our disposal does not allow of its proof, that n may be any real number or any proper or improper

fraction, or even may be a variable quantity. In the last case we have the means of representing the continuous rotation of a vector quantity.

Abbreviating the notation by writing j for $\sqrt{-1}$ we have a well known formula, e being the base of the napierian logarithms:

$$\epsilon^{j\theta} = \cos\theta + j \sin\theta,$$

which is somewhat more convenient for practical use. It is evident that if θ is a variable, proportional to the time t, we may obtain an operator which rotates a vector at constant angular velocity p.

$$\epsilon^{jpt} = \cos pt + j \sin pt.$$

The angle pt is the angle between the horizontal and the vector.

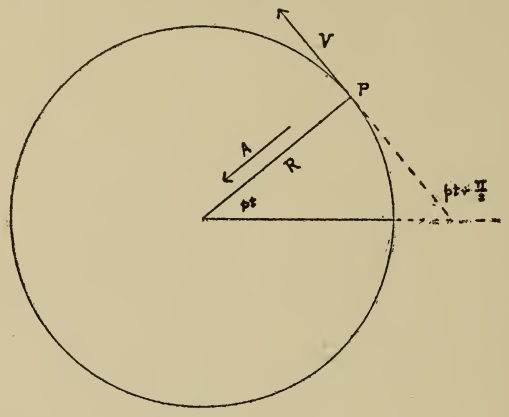


figure 3

An interesting simple application of this method may be made for the case of uniform circular motion. Let P be the position of a point at the distance R and direction angle pt revolving about the center of motion with angular velocity p, linear velocity V and acceleration A. We have the following relations:—

$$P = \epsilon^{jpt} R = (\cos pt + j \sin pt) R$$

$$V = \frac{dP}{dt} = j\epsilon^{jpt} p R = \epsilon^{j(pt+\frac{\pi}{2})} p R$$

$$= \left[\cos\left(pt + \frac{\pi}{2}\right) + j \sin\left(pt + \frac{\pi}{2}\right)\right] p R$$

$$A = \frac{d^2 P}{dt^2} = -\epsilon^{jpt} p^2 R.$$

The relations are illustrated in the figure. In making the transformations above it may be helpful to notice that

$$\epsilon^{j\frac{\pi}{2}} = \cos\frac{\pi}{2} + j\sin\frac{\pi}{2} = j,$$

and also in taking the derivative of a simple harmonic quantity of the form sin pt. or cos pt, that the derivative is $\pi/2$ or 90° further in advance in phase than the quantity from which it is derived, that is,

$$d \sin pt/dt = p \cos pt = p \sin (pt + \pi/2)$$
$$d \cos pt/dt = -p \sin pt = p \cos (pt + \pi/2).$$

Keeping the function and its derivative in the same form has the decided advantage that change in phase is brought out more clearly than by the more usual change from sine to cosine etc. met with in the study of differential calculus.

It is clear from the equations given above that the phase of the velocity V is 90°, and the phase of the acceleration A is 180° in advance of that of the position P.

Another simple illustration of this method is found for the spiral motion of a pendulum set in motion in what would be a circular path in a horizontal plane except for the effect of air friction which diverts the pendulum into a logarithmic spiral gradually drawing in toward the center of the original circle. The projection of this motion on a horizontal line is a damped harmonic motion similar to the damped motion found in free pendulums swinging in a vertical plane, the vibrations of galvanometers and the oscillatory discharge of a Leyden jar. Similar though more complicated phenomena are observed in the study of the transmission of current through long telephone lines.

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FIRST LESSONS IN GEOMETRY.

MISS MARION S. GERLS, DETROIT CENTRAL.

The little I shall be able to tell my hearers must, of necessity, be limited to those experiences which have come in my way, while traveling along the path of the allotted subject.

I am going to ask indulgence for a moment or two while I make a passing reference to the subject of teaching, generally. The argument is made over and over again that the teacher, to be successful in his chosen field of employment, must love the work. If this is true of the teacher generally it is especially true of the teacher of Geometry. To inspire and interest a class in this study I contend that one must first have undoubted faith and confidence in one's own ability and qualification. Without such confidence, or assurance, if you would so term it, the teacher's success with a class in geometry, as it appears to me, will not win extravagant congratulation.

During the first few days with a class of beginners in Geometry, it has seemed best, in my work at least, that very little attention should be given to a consideration of the real subject, but that the class should be led step by step to a feeling of familiarity with the environments, of acquaintance with one another, and to at least some degree of confidence in their teacher. This rule may apply in a measure to any kind of class work but it has appealed to me as exceptionally adapted to a class of beginners in geometry.

There are three important factors which have appeared to me to enter largely into the question of successfully teaching mathematics. I shall attempt to define these as, first, the attitude of the teacher toward this particular study, second, the view with which the pupil regards the subject, and third, the light in which the teacher and pupil see each other. It is my aim to try to weigh up the relative importance of these factors, and through

a few days work in the beginning, with now and again some familiar talks along interesting lines, lead my class into an attitude of mind through which these conditions will readily adjust themselves.

The first lesson assigned to a class of beginners in geometry will, naturally relate to definitions of the geometrical concepts. In this lesson I find an admirable opportunity for awakening in each pupil a strong desire for independent and concentrated thought. It always appears to me one of the most efficient helps when the pupil recognizes and appreciates the importance and the need of thinking. At times I find my own ingenuity pretty well taxed in an effort to discover some original process which will force upon a certain pupil in the class, a desire to concentrate his mind upon the lesson and on the particular question we are considering. And I find it especially helpful to create in the mind of each a strong desire to be in the class on the following day.

While I assume, as a matter of course, that each pupil coming to the class knows the lesson perfectly I do not hold the class to a rigid or formal recitation, but instead, I begin with a sort of informal talk about these geometrical concepts, turning for a few moments to some familiar topic such, for example, as "Who is the author of this book we are using?" and "Why should this author consider himself qualified for writing a book for the use of high school pupils?" This refers them to the title page. Then I may turn the conversation to a few words along the line of copy-righting, and soon branch into a general inquiry of the class to learn how many there are able to tell what is meant by giving the *definition* of a thing. I call on one to define some familiar object, or to give a description of some piece of furniture in the room and thus gradually bring about the need of a definition for a solid. Our author's first statement is "A material solid occupies a limited portion of space." This conversation will very likely bring to light the fact that a decided difference of opinion exists concerning the real meaning of "material" and that different members of the class will have dissimilar or discordant ideas and thoughts as to the meaning of "solids," "space," and other relevant and important terms. These definitions and opinions create much general interest and awaken a lively attitude of the class toward the lesson.

When I ask a pupil if he imagines that any matter is positively solid and give the assurance that the class will soon come to an understanding of the reason why it is impossible for matter to be solid, I notice that a look of incredulity creeps over the faces of the class, and then, when I introduce the idea of vibratory action, I can see the faces light up with a glow of intense curiosity. Following this up I introduce an easy or conversational discussion upon the idea of dimensions, asking for definitions, and coming gradually to the story of the man of lineland, and of the man of flatland, thus leading up to a consideration of the man of three dimensions, the conversation soon begins to excite a lively interest. The teacher who is inter-

ested in the thought development of today can hardly help asking about the fourth dimension when some bright boy will ask for a figure to represent it.

Then comes the statement, mysterious to the pupils, that we cannot see the geometrical concepts. By telling them that this is not new to them, that they have always worked with invisible concepts, the class will be turned into an interesting guessing party. All sorts of answers will be given until some one will think of figures as representing numbers—then words representing thought—letters-sound—, and so they can be led on until for the first time they discover that even the body is but a symbol of the real self. Right here the teacher has a wonderful opportunity for a life lesson that the pupil will remember long after he has forgotten Geometry.

The second day we discuss the angle, which is as difficult for the pupil to understand as it is for the Mathematician to define. This definition may be illustrated by having students walk from a corner of the room making different angles with the side of the room, or by the revolution of a pencil from its first position about one extremity, or by using the points of compass, from which the pupil will get the number of degrees in a right angle and also in its parts.

The definition of a theorem is quickly understood by calling it a conditional sentence. The pupil easily makes application of this selection the Hypothesis, and the Conclusion in several theorems.

We find the self-evidence of the Axioms depends upon the self, and we must patiently work even with these until the pupil understands how to apply even one so simple as, "Things that are equal to the same thing" etc. He does not understand why the same thing is not included in the conclusion. Often the pupil will quote this axiom without knowing what the *same thing* is, or what the *two things* are. In the Axioms, "The whole is greater than any of its parts," and "The whole is equal to the sum of its parts" can be given an appeal for best scholarship and best citizenship which is always needed and appreciated.

The first theorem we have is: Two triangles having two sides and the included angle of one equal respectively to two sides and the included angle of the other are equal in all respects. The day it is assigned as the lesson I repeat it once and ask the class to repeat it in concert—then ask for the separation of the Theorem into the Hypothesis and the Conclusion. Then I draw the figures, carefully constructing according to the hypothesis—telling the pupil to observe closely so he can do it on the following day. The pupils enjoy the accurate drawing and all that is necessary in teaching the pupil to make angles equal, is to tell him to make the lines the same distance apart at the same distance from the vertex. I then give the demonstration, after which I call upon some member of the class to give it. There will be several in the class who can do this, while from lack of imagination others find superposition very difficult; for these we draw two polygons and then apply one to the other. They will learn before completing this that the direction

of a line from a given line depends upon the size of the angle made with the given line—and that the location of the next vertex depends upon the length of the side.

Theorems one and two are learned by oral lessons—the pupil not reading the demonstration in the book. They are warned from the first to learn the *theorems* exactly as given but to avoid memorizing demonstrations. From the very first the pupil takes his place at the board standing where the class can see the figure and learning to use a pointer by pointing not *at* but *to a letter*. This accurate pointing helps the one reciting and it is a great aid in holding the attention of the class and, also, in making it easier to follow the demonstrator.

The application of the hypothesis, the application of the conclusion, the demonstration proper, the student will gradually learn to give in the right order, but, during the first two or three weeks, the teacher will have to be patient and constant in giving suggestions.

No mistake is too small to be corrected as it is best to insist upon accuracy from the beginning even in naming lines in the right direction.

We all recognize the difficulty in preventing memory work as the pipil can make a better appearance before the class by reciting something he has memorized rather than by thinking his way through the demonstration. The pupil is given plenty of time at the board to think.

The teacher of Geometry must constantly keep in mind that education is not learning but is exercising the power of the mind. The pupil should learn this early and more praise should be given for the simplest original demonstration than for the most complicated one which is given to him. Early, also, should he learn the use of the syllogism and so hunt for the two statements which put together will give him a conclusion leading in the direction of the result, then hunt for *another* statement to put with this conclusion until he can make another conclusion and so on until the theorem is proved. The pupil must see that a demonstration is like a tree in which leaves, twigs, and barnches grow out of what precedes.

Direction of thought, choice of truths leading in that direction, and combining them to the right end, these should be brought early to the attention of pupils and put in practice. This I try to do by telling them to consider, every time they prove a point, how the statement is to be used. Why is it true? Why did I prove it? Where do I use it? A large number of simple treorems on proving triangles equal is of great value to the pupil.

Often a pupil understands a principle but fails in applying it to the geometrical concept. For instance, in the demonstration of "At any point in a straight line only one perpendicular can be drawn to the line which shall lie in the same plane with the line," two angles are proved unequal by comparing them with angles that have been proved equal. This principle we illustrate the day the theorem is assigned by having four boys A, B, C, and D, stand before the class, B. and C. being of the same height, A. taller

than B. and D. shorter than C. The class will easily conclude that A and D are unequal in height. Tell the pupils to look for this principle in the lesson for the following day. All will be interested and there will be few failures. This third theorem introduces the pupil to the indirect proof. He will understand the simple statement if *this* is true *that* is also true, *that* is not true therefore *this* is not true. If the pupil early gets the correct idea of the indirect proof it will be of great asistance to him especially if the author uses many of them as does Sanders in six of the first eighteen theorems. The pupil should be able to give a description of this proof as,—suppose the conclusion false and something else true, continue the argument until a statement is reached which contradicts a previously proved principle, a definition, an axiom or the hypothesis in the theorem, then it must follow that the *first* supposition is false and therefore the theorem is true. I insist upon the statement which contradicts.

Our theorem four is based upon the equality of triangles. Let the pupil understand that triangles are always proved equal for a purpose—either to prove two angles equal or two lines equal. I give them the word homologous early, to avoid confusion.

If at times there is a lapse of memory in regard to some mathematical principle or operation that it seems to us that pupils could not help knowing let us not find fault with him but stop right there and help him to recall that with which he was once familar. If we are going to assist the pupil, we must do it at the place where he needs assistance. Ideas take possession of us according as we dwell upon them and use them. First I try to be sure that the pupil has a clear conception, then hope that eternal repetition may fix the principle in his mind.

The student must understand that a demonstration is like a rope ferry with one end of the rope attached to the hypothesis, the other end to the conclusion and he must work his way from the first to the last, that is he must pull thru the demonstration. Of course from the first good English must be insisted upon.

Often a pupil makes a correct statement without understanding it. This is for the watchful teacher to discover and correct by questioning In such a case we often hear from the pupil "I knew it but you confused me by your questions."

By asking the pupils to study, a part of the recitation hour, we will see that they are saying the words over and over—that is—studying mechanically. This, while of value in some subjects, is fatal in Geometry.

The boy or girl is often deceived in his own work and is unconsciously memorizing. During the first two weeks the studying except the memorizing of theorems should be done in the class room. There is a place for memorizing in Geometry and in that place it must be thoroughly done. I insist that

as the pupil recites a theorem he must have in mind the figure which he is describing. He must always visualize the figure—or he can not do the work—my practice is often to ask the class to hold in mind the figure while different ones give in order the principles used in the demonstration. This requires concentration. Schulte says, "The teacher must guide the pupil into the slow, judicial method of study. This excessive use of memorizing and the neglect of the cultivation of the reasoning power are possibly the worst effects of the spectacular idea upon which our schools are largely built."

The slow, thoughtful recitation is to be encouraged. Never hasten the pupil who is thinking. In Geometry the data are few and definite; the reasoning simple and accurate; the results certain. There is no chance for personal opinion. The pupil learns to know when his work is right. Clearness and exactness are necessary in life. *These,* Geometry should aid the student in gaining. The *pupil* soon learns that the subject is not informational but that power is the end in view. We are all familiar with the bright happy face which shows that the pupil has discovered that he has within himself the power to take the data and work to the conclusion. Many difficulties there are of which I have not spoken but let us teachers not be too anxious, knowing that when our duty is conscientiously done, we have nought to do with results, for we are only the instruments thru which the Universal works.

BIOLOGICAL CONFERENCE

AGRICULTURAL BOTANY.

PROFESSOR WALTER FRENCH, MICHIGAN AGRICULTURAL COLEGE

The subject of Botany may be considered as the elementary science of our secondary courses. It is at least the basic science for the subject of agriculture. Its place in the course of study may be debated because it is probable that pupils in the 9th grade have not sufficient maturity to derive the largest possible benefit from the subject, but because of its basic character it will in my judgment be necessary to introduce the subject at that point in the crriculum. In the preparation of this paper I have received valuable suggestions from Professor Bessey of M. A. C., and Professor Hummel of California.

I do not think it necessary to make any very sharp distinction between Botany and *Agricultural Botany,* for the whole subject, as treated in sec-

ondary schools, should be considered a unit, and the agricultural phases presented and discussed as they appear in the progress of the work.

The character of the instruction in Botany in the secondary schools should vary somewhat according to the location and environment of the school and the student. If a school is located in a part of the state where horticulture is the dominant industry, then the student of Botany in that place should give particular attention to the subject of plant propagation as related to the plants cultivated in that community.

In the suggested course in agriculture as presented for the schools of Michigan, we specify Botany and Agricultural Botany, but we do not mean by this necessarily that the first half of the year shall be given to pure Botany and the second half to agricultural application. We believe that because of the basic character of the subject it should be given an entire year, and the instructor should recognize the environmentta conditions, as above stated, and he should also adjust the work according to seasonal conditions and vegetation which may be studied. For instance, in the fall when plants are fruiting, the student should be given opportunity for study of the text and practical observation of fruits; while in the spring of the year the subject of plant propagation, seed testing, etc., should be given attention. If the botanical laboratory is properly stocked with preserved samples, the seasonal conditions will not affect the subject so materially.

The first work of the student will be devoted to the structure and function of plants, also a general sketch of the whole vegetable kingdom, so that the student shall secure a vision of what Botany means. This work will be followed by learning how to identify plants and how to use a botanical manual by actual observation and experiment work in the laboratory. During the fall and spring months it will be profitable for instructor and student to have laboratory exercises out of doors in connection with plant life in its actual conditions, as to habitat, manner of growth, manner of reproduction, and practical use.

It is my opinion that the first few weeks of the freshman year should be used by the instructor in science in giving to the student a hasty glance of the general fields of science. This can be done by means of lectures and simple illustrations and experiments touching upon the different phases of science. This will arouse the interest of the student and show him the possibilities of future study. I believe this is a vital thing in connection with science in our secondary schools, and the instructor should arrange to give to the students a series of demonstrations touching upon fundamental terms and processes in Botany, Zoology, Physics and Chemistry. It is not necessary to go into detail as to what the instructor should do.

For the purpose of this discussion we shall consider that the regular instruction in Botany will be planned by the instructor to fit into the agricultural phases. Then I would make the following suggestions on the agricultural side:

Sufficient study having been given to plant structure, the student will use the microscope in determining the structure of the chief plants grown on the farm for commercial purposes, such as corn, wheat, clover and alfalfa. In the regular botany work he should have learned the use of the botanical manual so that he can classify agricultural plants, at least the commoner families. The entire Botany class should work together to build up a herbarium for the school. That is, a collection of the plants which are native and which are cultivated in the community where the school is located. The Botanical laboratory should contain a proper case for preserving these specimens in such a form that they will be easily accessible, and can be used from year to year. The collection can be replenished from time to time as necessity requires.

After studying the cultivated plants, the students may take up a study of weeds and in this they will give particular attention to their manner of growth, the crops they infest, the modes of disemination, and how they may be destroyed. This will include a careful study of the structure, form and appearance of the seeds of such weeds as contaminate farm crops. In connection with this the students will make a careful study of the seeds of said farm crops, such as the several varieties of clover, alfalfa and the food grains for purity, and commercial rating or judging.

After this work has been done some time should be given to the study of plant diseases. Of course the student in the high school will not be able to go very far in this subject, but he may go far enough to learn to recognize rust, smut, scab, blight, and other diseases and fungus troubles, the aim being to train the student to be able to recognize these so far as possible with the unaided eye. Then in connection with his work in farm crops and horticulture he will study the various means of combating these pests.

I have made no attempt here to suggest this line of work in the order in which it should be presented in the school, because of the varying conditions which the instructor will find. I have only tried to outline in a very general way, the subjects of study that may be considered under the head of Agricultural Botany.

The following sketch gives somewhat of my idea of the order of presenting the topics in the Botany and in the Agricultural applications which may be made as the student goes forward with the different chapters and topics as they occur in the ordinary text book. The instructor in agriculture should understand, as every other instructor, that if the order given in the text which he does not coincide with environmenttal conditions or the best use of laboratory and apparatus, he is at liberty to take up the topics in a new order, or he may change the order as given in the text to meet his conditions. I am not presenting this as a compendium of botanical information, nor as a complete guide to the teacher of botany, but simply as a suggestive plan which may be used as a guide in working out the year's study.

BOTANY.

1. The Plant.

1. Composition of the plant.
   (a) Essential ingredients, elements necessary to plant life.
   (b) Water, (c) Ash, (d) Protein.
   (e) Carbo Hydrates:
      1. Celulose.
      2. Starch.
      3. Sugar.
   (f) Fat.

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2. Plant Structure.
   The parts of a plant and functions. Conditions under which they may work successfully.
   Economic uses of each part of the plant:
   (a) Seed. (b) Roots. (c) Stems. (d) Leaves. (e) Flowers. (f) Fruit.
   Elementary study of the cell.

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3. Physiology.
   (a) Activities of the plant;
   (b) Growth of the plant.
   (c) Propagation by different methods—seeds, buds, cuttings, etc.

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4. Environment, light and heat.
   (a) Effect on plant growth of light and heat. (b) Influence of seasons. (c) Temperature for germination and growth.

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5. Environment, Air moisture, Soil.
   (a) What are the conditions necessary to plant life and growth?
   (b) Quantity of moisture required.
   (c) Functions of the soil.
   (d) Kinds of soil.
   (e) Properties of soil.
   (f) Soil moisture. (1) Sources, (2) Functions, (3) Amount required for crops.
   (g) Soil air and soil ventilation, how secured?

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6. Plant Food.
   (a) Elements needed in plants
   (b) Sources: (1) Air, (2) Soils, (3) Fertilizers.
7. Classification of economic plants:
   (a) Cereals. (b) Grasses. (c) Legumes. (d) Vegetables. (e) Fruits. (f) Tubers. (g) Roots. (h) Sugar plants. (i) Oil plants. (j) Fiber plants. (k) Stimulants. (l) Medicinal.

Application, or Agricultural Demonstration.

1. The instructor may illustrate before the class physical and chemical changes, the preparation of oxegen, hydrogen, etc.
   It is not necessary to prepare all the plant ingredients. Study the more common ones Possibly the separation of water into its component parts.
   Students become acquainted with the common scientific terms.

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2. Examine agricultural seeds, parts of a seed, using a lens. Make drawings.
   Study germination. Germination tests, purity tests, tests for starch, protein, etc.
   Observe root systems of agricultural plants. In laboratory study root hairs, root cap, etc.

Study general structure and circulation; uses of stem; parts of a leaf; experiments in detecting starch; effect of light on starch and on leaves; outdoor observations of flowers, bees, pollination.

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3. Laboratory work or greenhouse work by pupils in plant propagation, seeding experiments, preparation of seed bed, depth of planting, care after planting.

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4. Demonstrations to show methods of heat transmission, convection circulation, etc.
Experiments to show effect of different temperatures on plant growth.
Teach use of soil thermometer.
Demonstrations to show the temperature effect of different colors of soil, the effect of cultivation and drainage.

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5. Laboratory demonstration in the preparation and properties of oxygen, hydrogen nitrogen, carbon dioxide, etc.
Use of a barometer.
Practice in the use of weather maps.
Experiments to show the necessity of air for plant life.
Field trip to note differences of soil formation, erosion, effect of heat and cold, etc.
Examination of typical soils in the field and in the laboratory.
Observe the work of the earth worm.
Experiments to show the effect of moisture upon soil temperature, soil porosity and drainage.
Effect of tillage.
Experiments of tillage.
Experiments to show the effect of different mulches.
Field trips to observe drainage systems.

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6. Give demonstrations through pot culture, or the use of different soils in different pots or jars, in which plants are placed, and experiments followed by adding lime, potash, chloride, nitrates etc., to the soil in the pots. It would be best in this to use pure sand in each of the pots to begin with.
Field trips for the purpose of examining clover, alfalfa and other legumes, showing no dules of nitrogen fixing bacteria.
Field studies in the care of manure and fertilizers and the effect of plowing under coarse material.

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7. Field and laboratory study of these crops.
Observation of methods and judging of produces, that is, corn judging and grain and fruit judging.
Field trips to observe smuts, rusts and plant diseases.
Field trips for collecting and listing the weeds of the locality.
Study of the method of dispersal and how the weed injures crops.
Observation and study of har-

vesting preparation for sale or shipment and marketing of economic plants.

8. Weeds.
Habitat, manner of growth, time of flowering and fruiting, method of seed dispersal.
Application, or Agricultural Demonstration.
Appearance, size, habits, visibility of seeds, methods of destruction.

9. Plant enemies. Kinds, life history, destruction.

10. Forestry.
Names of shrubs and trees, habitat, manner of growth, appearance, means of identification.
Methods of tree and shrub propagation, planting and pruning. The wood lot. Care in removing trees, methods of replenishing. Life of trees.

11. Decorative plants.
Varieties, duration, color effects.
Methods of propagation, care and culture, landscape effects and planning.

As stated before, this is by no means a complete sketch or outline, but it is sufficient to show the character and trend of the work in regular botany and agricultural botany, together with practical demonstrations and study which are to be made in the laboratory and out of doors. It goes without saying that the teacher will be the chief point of inspiration in this work. His enthusiasm and energy will go far toward leading the student out into the spirit of the real naturalist.

It would seem that such a treatment of the subject of Botany would make it both interesting and practical as a subject of study in the secondary schools.

SUGGESTED COURSE FOR HIGH SCHOOL ZOOLOGY.

To Correlate with Prof. French's Sggested Agriculture Course.

GENERAL STATEMENT.

PROFESSOR JESSIE PHELPS, STATE NORMAL COLLEGE.

The High School course in Zoology must of course first of all set forth the fundamental principles of biology:—cell structure, growth, development, organization, etc. Secondly, it should show the application of these principles to human life directly in the physiology, psychology, and personal and social hygiene of man, and also thru the agricultural and home industries that are concerned in the care, use and breeding of animals and plants, and in the aesthetic, sociological, and ethical relation of man in all aspects. It should be so related to man's working philosophy as to interpret some of the more important and common phenomena of life, such as birth, death,

heredity, and social instincts, and it should be shown helpful in the solving of most of life's problems. Pure enjoyment of life should surely be enhanced by the study of zoology.

The method of attack should be chiefly that of the laboratory, divided between field and indoor work. The student should be led to *state problems* as far as possible and to devise means of solving them. Individual, original and intensive work should be encouraged. Accurate observations and records, as far as they go, should be insisted upon. Library work should supplement the laboratory. This should lead to a brief study of the methods of investigation employed by men of authority. The theories and evidences of evolution and the economic, aesthetic, and ethical applications of zoology should be sought out, that is, the student should be made aware of the philosophic bearing of these topics. It is not supposed of course that an exhaustive discussion will be entered into,—the doors will be simply opened.

The following list of topics is suggested to meet these ends:

I.

MAMMALS.

About four weeks should be devoted to the study of mammals. This should include the rapid dissection, either by the individual students or by the instructor in demonstration, of some small mammal, such as a rat, rabbit, or cat; the general anatomy and physiology of every system of organs, including the ductless glands and details of one or two muscles; the history of the animal at hand and its allies; adaptive features; vestigial organs; general embryology of mammals including the features of the early and later stages; study of reproductive cells and fertilization; embryos in utero at two or three different stages; study of placenta and fetal membranes; birth, mammary glands, relation of number of young to care of young; birth rate versus probable death rate.

II.

BIRDS.

Two continuous weeks and some scattered work throughout the year; general dissection of English sparrow or pigeon; anatomy and physiology of every system of organs; (for muscles the pectoral and the perching muscles should be done in detail); evolutionary history of birds; adaptive features; embryology; study of the reproductive cells; study of the first four-day chicks; comparison of the breeding habits of the precoces and the altrices; study of some wild birds in the fields with methods of exterminating undesirable and protecting desirable species (use State, Government, and Grange bulletins); field problems of migration, breeding, feeding habits, etc. should be studied at beginning of course and continued for one full year unless such work has been thoroughly done in the grades.

III.

INSECTS.

Three continuous weeks work and some scattered work throughout the year; collection and identification started in fall and continued *twelve months.* This will necessitate some summer vacation work which can rather easily be suggested by the teacher in June, most of the collecting of insects, birds' nests, and some ecological studies of other forms being best done by the pupils in this way. Special studies of those insects peculiar to grain-fields, gardens, orchard, shade and timber trees which are of interest to the community; general ecology of insects; life history and relation of a few insects to diseases of man and domestic animals and plants; special study of the anatomy and physiology of the tomato or silk caterpillar, grasshopper, fly, mosquito, and honey-bee—the two latter in both larval and adult form; evolutionary history of insects and their relation to the allied groups of arachnida, myriopoda, crustacea, annulata.

IV.

GENERAL SURVEY OF ANIMAL KINGDOM.

Four weeks' study of main groups taken in general evolutionary order:

1. Protozoa (amoeba).
2. Coelenterata (hydra).
3. Sponges (fresh water and Grantia).
4. Annulata (earth worms).
5. Arthropoda (crayfish).
6. Echinodermata (starfish).
7. Mollusca (snail and mussel).
8. Fishes (perch).
9. Amphibia (frog or toad).
10. Reptile (snake or turtle).
11. Birds.
12. Mammals.

Histology (study of type cells in muscle, gland, brain, bone, blood). Régime of evolution, heredity, adaptation, etc., should find a place in the latter part of course. (Part of this may be allowed to run over into the Physiology course.)

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I would have this course put in the *first* semester of the *eighth, ninth,* or *tenth* grades, preferably the eighth, and I would have it followed by a laboratory course in physiology and hygiene. The small amount of chemistry actually needed for the work in physiology can be introduced early in the course. The course can profitably be supplemented by a reading course in civic hygiene and in eugenics, which may come at the same time or later.

The work on mammals is placed first for pedagogical and ethical reasons. Pedagogically this procedure is from the best known and most interesting to the least known; ethically it dispels at once the sense of shame that enshrouds at present the subject of human anatomy and physiology in our pupils' minds, and it also opens the door for full and free discussion, giving an opportunity for personal instruction in matters of sex which may be demanded, and which is much needed by the pupils of the Junior High School. If the work is extended over ten months the order here given is urged; but if the course is only one semester in length, the order is immaterial, and the needs of the particular school should, of course, be met.

DISCUSSION.

(Written out in part after the meeting.)

In defense of the course in Zoology as outlined, I wish to say:

1. Nothing in the world is so practical as an ideal. In framing the course I have tried to have in mind the social conditions into which we are trying to fit our boys and girls. I have tried to say what *ought to be,* in the belief that working consciously toward such an end will accomplish far more than working without the strenuous, distant ideal.

2. I have left the economic and industrial phases of the subject wholly for the course in Agriculture with which it is supposed to correlate. Milk testing, textile work, etc., will be largely taken care of there. Then too we should try to remember that this is to be a *cultural* course, that its cultural value is the chief and most eternal one.

3. It is objected that the course is too full. For one half year, I think so too. The wise teacher will pick and choose, and even for a whole year's work, involving the long vacation, many of the topics can barely be touched upon. The average college professor would find it difficult to give the course in nine months, for the simple reason that he knows too much. Our boys and girls need to have the subjects opened up, the field pointed out, the line of thought indicated, books and authors suggested rather than long and learned disertations. The right words at the psychological moment will satisfy the majority for the time being and may be stored up for future use.

4. The amount of dissection is objected to and "preserved cats" disparagingly spoken of. As I think of it the actual dissection is reduced to a minimum, much of it being demonstration work only. If the students are correctly prepared there need be no or only rare expression of aversion. The sight of blood even, need never be objectionable and it too can and should be prepared for. If the work of dissection is done as rapidly as usual with high school students the material need not be kept more than three or four days at the most, or if the demonstrations are arranged correctly for small groups fresh specimens may be had daily.

I used to take care to prepare my specimens before class time so as to

save my pupils the pain of seeing them die. Now, with forethought, but not maliciously, I plan to let the class see the animals die, for I believe that even eighth graders need to try to meet the fact of death with some equanimity. It is *the* great inevitable thing that we all must face and we cannot afford to be afraid. I have learned to say some word that helps my college students, and I have known high school teachers who did the same. Instead of regarding life less highly they reverence it the more.

If the dissection can come at or near the time when the children are in the so-called "hunting stage," when they are by very nature blood-thirsty, I believe the painless death and the careful dissection will bring satisfaction and that it will tend to lead away from the brutal instincts to those of right consideration.

5. I should not dwell long nor delve deeply into the evolutionary problems but I would not be afraid to meet the questions when they came. More than likely the history of the horse and the development of the frog will furnish enough material, but attention can be called to many other illustrations. Because evolutionary ideas do explain our universe and lay a foundation for a rational religion our adolescent boys and girls particularly need it. In connection with adaptive features such work as Miss Ellis suggests on dentition of mammals can easily be done.

6. I suppose my outline presupposes a pretty comprehensive course in Nature Study in the grades. It needs close relation with such work and also with the physiology and hygiene which should follow. I also believe it demands mature teachers preferably those who have had the experience of parenthood.

7. Lastly, I see that I have shocked many of you by all that I propose concerning the teaching of the reproductive processes and organs. Of this there is too much to be said to allow of complete presentation now. If one is to dissect at all he cannot avoid doing something with the reproductive systems and the only frank and sensible thing to do is to treat it as all the rest, with no more but certainly no less emphasis than the other systems.

I should most certainly avoid either in the grades or elsewhere having a course *called* Sex-Hygiene, but I should most certainly want every teacher in the entire school ready to meet the emergencies that are constantly arising in connection with this subject and because of the social fact of sex. The literature teacher, the art teacher, the teacher of civics, each has her own opportunity of establishing ideals of love and marriage. It is of course the *ideal,* not the knowledge of anatomy or physiology, that is going to make our boys and girls right-minded,—but the knowledge of plain facts can be made to help, for there is nothing ultimately so "sacred as a fact," and as Professor Bigelow said this morning, biology is the *only* approach to this broad deep subject. It may be made to satisfy legitimate curiosity; it may establish correct images; it may give a basis of right thinking. To

pass over slightingly the organs of reproduction is to arouse a suspicious and secretory attitude on the part of the pupils. To speak with dignity and frankness makes vulgar thought impossible. Only last week a certain high school class (tenth grade) was dividde into groups, each with its white rat to dissect. The teacher passed around to supervise and help in the identification of the parts. As the female organs were pointed out one big boy looked straight into the eyes of his honest teacher and said, "Is that all?" having evidently expected something very complex and peculiar. There was no snickering, no giggling, no wrong word or look.

The earlier these plain, everyday, universal, vital facts can be known the better. If before puberty then there is full opportunity for the pressing home of an ideal, that should be re-emphasized—without preaching—in the literature, art, and civics, during the early days of adolescence, when philosophizing comes as naturally as breathing and the religious and chivalric impulses are awaking. In the hygiene classes where the boys and girls are later segregated, something further concerning the care and right use of the body should be undertaken.

All of these conclusions I have been forced to by my knowledge of the very frequent illicit intercourse of boys and girls in our schools, the early marriages of many, the utter lack of teaching on the part of parents, and the prevalence of veneral diseases. But even when all social evils are done away with, and all parents are capable of instructing, will not the schools still need to recognize the world's problems, and supplement the home and church training? If we wish to awaken interest and secure virile effort we must make use of the industrial and social and emotional life of our pupils.

The following references may prove helpful in trying to formulate an opinion on the subject:

1. *Allen's* Civics and Health, Chap. XXXIX. Ginn & Co.

2. *Putnam*—Instruction in the Physiology and Hygiene of Sex: Its Practicability as Demonstrated in Several Schools. Heath & Co.

3. Educational Pamphlet No. 2. Instruct. in Physiology & Hygiene of Sex, by the Society of Sanitary & Moral Prophylaxis.

4. *Morrow*—The Teaching of Sex-Hygiene. American Federation for Sex-Hygiene, N. Y. City, 105 W. 40th St.

5. The Problem of Sex Instruction by various writers and from several standpoints. Journal of Education, March 21, 1912. Vol. LXXV.

6. *Phelps*—Sex-Social Functioning & Biology. School & Home Education., February, 1912, Vol. XXXI, p. 237.

(There are many other references which the speaker will be glad to furnish on request.)

A RECONSIDERATION OF THE HIGH SCHOOL COURSE IN BOTANY.

PROFESSOR JAS. B. POLLOCK, UNIVERSITY OF MICHIGAN.

The educational world is passing through a period of unrest, transition and experiment. The leaders as well as the rank and file in the organization of this field have reached the conclusion, that with all our boasted educational advances we have somehow failed by far to attain those results which we feel we ought to attain. This dissatisfaction with the immediate past is manifesting itself in a very general demand that education be made more practical, that it have a close relation to life, in short that it be vocational.

The dissatisfaction is not confined to any particular department in the educational field, but our special interest in it concerns the department of the natural sciences and more especially the biological sciences.

It cannot be denied that high school courses in biology have lost standing in the eyes of many high school principals and superintendents as compared with the standing they had fifteen to twenty years ago. Even the strongest advocates of sciences are forced to admit that the results have been disappointing. Admitting this as true to a certain extent, is it not possible by examining the past to discover some of the reasons for this failure and to strengthen our courses in such a way as to obtain better results in the future? The time is opportune then for a reconsideration of our high school courses.

In response to the demand for vocational training a wave of enthusiam is sweeping the country in favor of courses in agriculture. As an art Agriculture is chiefly applied chemistry, physics and biology, plus business management. Its processes and procedures rest on the fundamental principles of those sciences. It follows that courses in agriculture offer an excellent opportunity for the sciences to make that "touch with life" so much demanded at present.

Some of the reasons given for the partial failure of science as an educational factor are that there is too little continuity and dependence of late upon earlier work in the course, and that there is little uniformity in the material offered in different schools, especially in the biological sciences, in short that the work is not well organized and standardized, in marked contrast to the condition obtaining in the teaching of languages in which there is very general agreement as to the material offered in the same grade in different schools, and a close dependence of later upon earlier work.

The lack of agreement as to material and order of presentation appears marked in comparing the text books written in the last ten years for high school courses in botany. Almost every author begins his presentation of the subject with a different part of the plant, or phase of its activity, one

with a study of the cell, another with the plant as a whole, one with food, another with structure of the seed, and thus there have been used for the starting point, the seedling, the root, the leaf, germination, etc. The most recent books show as much disagreement as the earlier ones.

Professor C. E. Bessay, one of the leading botanists in this country, has recently made a plea for a standardized course in colleges, and predicted that in the near future such a standardized course would be worked out. On the other hand it is the opinion of other leading botanists that it is not of so great importance as to what particular part of the plant, or even as to what particular group of plants is used for *beginning* the study. Much range of choice may be left to the teacher to be determined by personal preference, by local conditions, by the season at which the study is begun. etc.

A superficial view of the situation appears to indicate that there is no agreement among botanists as to what is most fundamental in the science and should, therefore, be used as a starting point. A somewhat more thoughtful view, however, soon discloses that with all the diversity of usage in beginning the teaching of botany practically all agree that the knowledge of the plant as a whole is necessary, what it does, how it does it, how its *structure* enables it to do its work, how it perpetuates its kind, how it is adapted to its surroundings, etc. It is not the leaf, or the root or the seed alone that is of fundamental importance, but the whole life of the plant. That is the key that unlocks the problems of botany. That is the alphatbet, a knowledge of which is necessary to the reading of the volume concerning plants. It makes little difference then with what part of the plant the study is begun, provided complete knowledge of its life is obtained. Furthermore, it is of little consequence, from the point of view of the science of botany, whether one species or another is used to illustrate the work of plants. But for the sake of making the contact with the life of the pupils at as many points as possible, it is wise to choose plants useful to man when they can serve as well as others to illustrate the fundamental principles of plant life.

As to the criticism that the teaching of science lacks continuity and dependence of later upon earlier work, it would seem that the teaching of agriculture offers the opportunity to remedy this defect in science teaching. Since in agriculture there is constant necessity to apply the principles of the four sciences, chemistry, physics, botany and zoology, the correlation of agriculture with the courses in pure science may meet the criticism both of lack of continuity and of dependence. It insures that repetition of earlier work which is a necessary condition of more perfect memory, and of the comprehension of more remote and more numerous relations. It is rare that any one of the natural sciences is taught for more than one year, and indeed, in many schools a year's work is divided for two sciences, as physiography and botany, or botany and zoology. Also, there is a growing

tendency to give a preliminary year to "general science" including something of several sciences. All this seems to go to the extreme in violating the law of continuity, and it does violate that law so far as subject matter is concerned. Such courses, however, may show something of that continuity of natural law which runs through all the sciences. Nature is one, though with many aspects. These aspects are represented by the various sciences but there is increasing unity among them as each widens the boundary of its field. Physics and chemistry have been united in physical chemistry. The knowledge in these fields is of increasing value in the biological sciences. Plants have a very fundamental value in the modification of certain physiographic features. Examples might be multiplied indefinitely. A course in general science, then, or longer courses in the several sciences, may exhibit the continuity found in the unity of the laws of nature. Also it may be taught in such a way as not to do that.

There is one other way in which courses in science may show a continuity, and it is perhaps the most important of all. It is the *continuity of Method.* The experience of the past has led and is leading many men interested in both science and education to the conclusion that method in science is of far more value educationally than subject matter. One man of high standing in the educational field has said (Dewey, in *Science,* v. 31, 1910), "In the order of time and importance science as method precedes science as subject matter." "Scientific method represents the only method that is fruitful in any subject." "The future of our civilization depends upon the widening spread and deepening hold of the scientific habit of mind; and the problem of problems of education is how to mature and make effective this scientific habit." Dewey even goes so far as to say, "that only the gradual replacing of a literary by a scientific education, can insure to man the progressive amelioration of his lot." Momentous words if true, and that there is at least a large measure of truth in them all experienced teachers of the sciences are ready to admit.

If then the *method* of science is of more importance than the subject matter, we should see clearly what are the essentials of the method, and how the scientific attitude of mind is attained. As to the essentials of Method, there is involved:

I. Unprejudiced observation of (a) nature directly; (b) of nature modified by experiment.

II. Recording the observation accurately.

III. Observation made by the student himself must be supplemented by those made by others.

IV. The facts learned by observation, by reading, lectures, etc., must be organized by comparison and classification, and by reasoning from them conclusions are drawn and general laws and principles are derived.

The scientific attitude of mind is attained by using the scientific method

until it becomes a fixed habit of procedure. It cannot be attained by the mere memorizing of text books. It may be used in the study of any subject, but in many subjects it can be used fully only in the field of research, and not in teaching the elementary courses. In the natural sciences, however, it may be applied in the most elementary courses. This is true because some phases of nature are at hand in every time and place, and some of its primary facts are open to direct observation or experiment.

The chief thing that distinguishes the discipline of the natural sciences from that of other subjects of study is that for a part of his work the student may determine for himself, the truth of the fundamental facts of the science, thus participating in the process by which "anything is entitled to be called knowledge, instead of mere opinion, or guesswork or dogma." This determining of the truth of the primary facts of a science may be done most easily in laboratory work, though with groups of students not too large it may be done successfully with field work in the biological sciences. It may also be done by the demonstration method, but when experiments are taught by the demonstration method there is great danger that the student will fail to get a complete record of the facts or necessary conditions of the experiment, hence for him the logic of the experiment breaks down, and the one thing essential in this phase of the scientific method, namely, proof of the conclusion, is lacking. In the biological sciences it is very often impossible to demonstrate perfectly the truth of a given proposition. It may be done only with a certain degree of probability, or it may be necessary for the observer or investigator to hold a suspended judgment. The scientific method then trains in the discovery of truth, and stating that truth in the form of judgments, in estimating the value of evidence, in recognizing the degrees of probability.

When the student has attained the attitude of mind that leads him to approach all subjects from this point of view, he has at his command the most efficient tool in his intellectual workshop.

Psychology has shown, however, that the discipline of one subject, considered as the method by which that subject is studied, is not readily transferred to other fields. In other words the value of formal discipline, of methods of study, is often lost, perhaps usually lost, through the inability of the student to transfer the methods to other subjects. The study of agriculture may in this connection be made of special value, since it offers the opportunity to transfer or carry over the method of science into at least one field of practical life. It is only this conscious transfer on the part of the student, of the method learned in one subject to other fields which gives formal discipline its general value.

The limitations of time make it impossible for any one student to prove the truth of all the facts of a science at first hand, hence he must supplement his own observations, his own conclusions by those of others, before he can organize his facts into a body of knowledge entitled to be called

a science, in which he perceives general laws and principles. Since any of the material of science may be taught by the scientific method it follows that selection of the material or subject matter does not depend on the method, but may be made on other grounds. The material selected for a course in botany should be that which is most illuminating, that which gives the greatest degree of insight into the life of plants as such on one hand, and into the relation of plants to the inorganic world, to other organisms and especially to man on the other hand. From both these points of view two groups of plants stand out above all others. They are not coordinate in systematic value, but they are complementary to each other in the work of the world. One is the group known as the spermatophytes, the other is the group of fungi, bacteria and yeasts. Considered merely as vegetation occupying the earth the spermatophytes are the great predominant group of plants. They are the largest in size and the most numerous in kind. By virtue of their numbers and size and their possession of chlorophyll, they are the chief means of changing the inorganic to organic material, the work which makes green plants the food manufacturers and energy storers not only for themselves but for all other living things as well. It is the capacity to do this work efficiently that makes the spermatophytes of the greatest importance to man, furnishing him materials for food, clothing and shelter. From this group of plants come man's chief crops, hence a knowledge of them and their work is of prime importance in agriculture.

The plants in the other group named, like those of the first, are important partly because of their relation to life as a whole and to inorganic nature, and partly because of their direct usefulness to man. These colorless plants have for their work in general the destruction of organic matter, or rather its transformation into inorganic matter, thus making it available for the life of many successive generations of living things. In their nearer relations to man some of them are detrimental to him as in causing disease, or spoiling his food, others are beneficial, as in maintaining soil fertility, in producing various fermentation products, etc. These two groups of plants then stand in antithesis to each other in their relation to life upon the earth as a whole, and a knowledge of both is essential to the understanding of the principles of agriculture, and of the relations of plants to man. The conclusion is that in choosing plants to be studied in an elementary course they should be chosen mainly from the two groups named.

The question then arises, what knowledge about these plants is most illuminating and therefore most valuable. It has been said above that the knowledge of the plant as a whole is most fundamental, the alphabet of the science. It includes a knowledge of both form and function, of structure and phyiology. It seems to the writer that from the point of view of agriculture, of crop production, a knowledge of function, of physiology, is of more importance than a detailed knowledge of structure. Of course some knowledge of structure is necessary for the understanding of physiology.

Probably the one factor that limits the yield of crops more often than any other is the lack of water. Water is the most immediate and pressing necessity of plants. Thorough knowledge of the water relation of plants should be obtained; how much water they contain; how they get it; how they lose it; how much of soil water is available to plants; how it is conserved in the soil, etc. A knowledge of these facts aids in giving control over plant production. The structure that may be studied in connection with the water relations are roots and root hairs for absorption, vascular bundles as paths of conduction, cork layer, cuticle and stomata as means of reducing the loss.

For the understanding of the place of green plants in nature and their relations to man in furnishing him food and energy the study of photosynthesis is most illuminating. The energy phase as well as the material phase should be made clear. Not only should the students understand that CO_2 and H_2O are the raw materials out of which sugar and starch are made with oxygen as a waste product, but they should see equally clearly that the radiant energy of the sunlight is transformed into chemical energy in the sugar and starch, and that this may again be transformed into heat energy, keeping our bodies warm if we eat the sugar and starch, or if we burn wood or coal under a boiler it may be further transformed into mechanical motion, electrical energy, or finally back into light.

The structure of leaves, of cells with chlorophyll bodies, of reservoirs for the storage of food may well be studied in relation to photosynthesis. The light relations of plants and some of the responses to stimuli may be studied in connection with leaves. Also the chief kinds of foods required by plants and animals may be studied, sugars, starches, cellulose (food for herbivorous animals), fats, oils, proteins, etc., the chief plants which are their sources for man, and the proportions of each in cereals, legumes, nuts, seeds and fruits, vegetables, etc.

The similarity of the foods required by plants and animals is one of the numerous facts showing the fundamental unity of life. Another of these facts is that of respiration which should be seen clearly in its relation to photosynthesis. The one process builds up organic matter and stores up energy, the other breaks down organic matter into simpler compounds, even into inorganic substances, and sets energy free, making it available for many purposes. This energy is expressed in heat units called calories, which may be calculated for the different kinds of foods, and students should understand the meaning of the term calorie.

Another touch with human life may be made, by showing how photosynthesis tends to purify the air for animal respiration, and that plants are beneficial in living rooms while they are lighted, but in the dark help to vitiate the air for respiration.

On the side of nutrition a knowledge of the chemical elements necessary for the growth of plants and the combinations of these elements which

the plants are best able to use in making the different kinds of their food is esential to our understanding of procedure in keeping up the fertility of the soil. This problem should be studied experimentally, at least in part. Something of growth should be studied, how plants grow from the seedling to the adult form, the rate of growth, the localization of growth, conditions necessary for growth, especially the conditions of temperature, water supply and food supply. Germination at different temperatures might be tested, and correlated with the temperatures out doors in spring, at time when seeds are commonly planted. Practical questions are the relation of the minimum temperature for growth to the time of planting for wheat, or oats, corn, beans and pumpkins, etc.

The growth responses of plants by which they adjust themselves to their environment may be studied in connection with growth in general, the responses to gravitation, light, etc., in general causing stems to grow up and roots down, and leaves to arrange themselves in positions favorable to receive the light.

In the study of Morphology and structure, the use of the microscope, while necessary for certain things, should be reduced to the minimum for high school students. Protoplasm, cells, cell nuclei and chlorophyll bodies, cannot be seen adequately without the compound microscope, and every student should see them, so that they will not be mere words to him. Likewise the bacteria, yeasts, and the spores of lower plants need high power of magnification. But there is so much of structure and morphology that can be seen with the eye alone or with a good hand lens, that it seems undesirable to have high school students spend a very large proportion of their time looking through the compound microscope.

The morphology of both the vegetative and reproductive structures of the higher plants offers almost unlimited material for observation with the eye alone, or with the aid of a hand lens, though the cells actually concerned in fertilization can be seen only with high magnification, and they should be seen.

The process of reproduction and the various methods of accomplishing it are of fundamental importance both for a scientific knowledge of plants and for the usefulness of plants to man. First and foremost among the reproductive bodies of plants are the seeds, and the great variety of structures concerned in their formation and distribution, involving fruits as well as seeds. Seeds and fruits and their accessory structures are of immense value to man as food and occasionally (cotton) as material for clothing. Kinds of seeds as to structure, as to different foods furnished, and as to species useful and detrimental to man, are topics that may be studied as far as time allows. Testing vitality of seeds is a practical problem. The arrangements for cross pollination by insects gives another opportunity of studying seed in relation to certain animals. Methods of seed distribution are of importance. A knowledge of the process of fertilization is essential

to the understanding of the laws of heredity, and this knowledge is essential to our understanding of how plants and animals may be improved by breeding. Many plants are propagated in other ways than by seeds, vegetative methods of propagation. A knowledge of these may be of practical value, as well as give insight into plant life. Many of our cultivated plants are propagated as crops by these methods. Some of these methods are by slips, or cuttings, by layering, by grafting, by budding, by runners, tubers, bulbs, etc. Some experimental work on cuttings is easily done.

A knowledge of variations of plants, of the degree and kinds of variation within a species or variety, and of variation among species and varieties lies at the basis of improvement of plants by selection, selection first of the best variety for a given purpose, and second selection for a high standard within the variety chosen for cultivation.

In the study of fungi, bacteria and yeasts some use of the compound microscope is necessary, and yet the most valuable knowledge about them is not their structure and morphology, but their physiological processes. In relation to life upon the earth as a whole they play the part of scavengers, decomposing organic matter, ridding the earth of the dead bodies of plants and animals, setting free the chemical elements that composed them, sometimes forming new combinations, and allowing those elements to be used over and over by successive generations of living things. In these transformations of organic matter the organisms concerned have many and varied relations to man. He must protect his food from them to preserve it from putrefaction, but in the soil this same process is necessary to keep up the soil fertility. They may spoil his cider, but in doing it they produce his vinegar. They may destroy sugar by alcoholic fermentation, but at the same time a gas is produced which under suitable condition raises his bread. They dispose of his sewage, but may poison his drinking water. They may cause disease of his plants, his domestic animals or of himself. A knowledge of their physiology, their distribution, and methods for their control is more important than to know their size, shape and structure. They should be studied partly by experiment to show some of these relations, and partly by observatoin to enable the students to recognize some of the most common diseases of cultivated plants.

Besides its value for training in method and its relation to practical life, science in general and biology in particular has other values. Let us mention the esthetic and recreative values. It seems often to be forgotten in the demands for vocational training, for "practical" education, that "life is more than meat" and that the "fullness of life" consists in the things over and above those just necessary for food, clothing and shelter. Even the beasts of the field get so much as that, and if the children of men are trained for nothing higher, "what pre-eminence has man above the beasts?"

By many it may not have been forgotten because it has never been realized that the ability to take healthful recreation in fields far removed from

the grind of practical life, especially for those in the less congenial, the soul-crushing occupations, that this ability has a value, even a money value; that the individual who can find such recreation will do better work and will last longer than the one who does not know how to spend his spare time except to his own detriment. But far more than the money value, healthful recreation has a moral, a spiritual value, to foster which is certainly as much the proper aim of education as to prepare for a vocation. In these recreative and esthetic values botany takes a high place. Perhaps these values can come most simply and naturally with the knowledge of the kinds of plants growing about us in a state of nature, and of those kinds planted for ornament about our homes, along our streets or in our parks, together with a knowledge of their adaptation to their surroundings in nature or their use under cultivation. The failure to give this knowledge of plants has been the cause of frequent and caustic criticism of courses in botany or biology. Under ideal conditions the knowledge of the common plants of a student's locality should be learned before he reaches the high school, but if they have not been learned then the high school course should give him something of that knowledge. In the larger cities this problem is a difficult one, but the streets or vacant lots, the parks, and even the markets, may furnish material. The knowledge which is most satisfactory is that which enables one to recognize a tree, a shrub or a flower at sight, as one recognizes a friend, by salient characteristics, not by a complete technical description such as is found in the manuals of botany. The use of the manual should be taught to those who are interested enough to want to know how to identify plants with it.

Some writers on educational topics recognize what they call the interpretative value of science. The attainment of that mental state which enables one to see or recognize rather than to solve, a situation. This value is hardly to be attained by learning either a method of work or any given set of facts as information. The method and information may enable one to *solve* the situation presented, but not necessarily to recognize it as a situation requiring solution. This latter ability seems to me to depend on a natural alertness of mind, an ability to see readily new relations that are quite remote from those learned by previous experience. It is not readily attained by any definite activity on the part of either teacher or pupil, except that a thorough understanding of the subject is favorable to it. Its attainment can hardly be made the special aim in course, but it must be incidental.

Science has also a cultural value, and by that I mean the attainment of that state of mind which enables one to see those wide and far-reaching relations that give perspective, and enable one to estimate values correctly in the various fields of man's activities, to see his place in nature and to obtain that "imaginative insight into human life," which is perhaps the essence of culture. The culture value of science is not a thing wholly apart from

the other values. It might be called the higher synthesis of those values, which sets them all in their proper perspective, and sees science itself in its proper relation to other departments of human knowledge. Such perspective is obtained when the student sees that, however different man is from the other animals and the animals from plants yet they are all one in having similar substance, the protoplasm, as the physical basis of life, in having cell structure, in being dependent upon the same kinds of chemical substances for foods; that all are dependent for matter and energy upon the food manufacturing and energy storing capacity of green plants, that the energy so stored is transformed sunlight, that the energy stored up in the coal, perhaps millions of years ago, is only transformed sunlight which on further transformation turns the wheels of industry for so much of human life; that in the work of nature as a whole the fungi and bacteria have a necessary part to play in the destruction of organic matter; that in carrying out their work they are sometimes directly opposed to, sometimes directly in harmony with man's immediate wishes, but always absolutely necessary to the flux and flow of organic and inorganic material; that perhaps the causation of disease by bacteria is to be considered as only one phase of this change of organic to inorganic matter; that pain, or at least the capacity to suffer pain is a necessary condition of the development of conscious and intelligent life, that pain is at once a warning of bad adjustment to environment, and a stimulus to the study and better comprehension of that environment; that apparent stupidity of school children is often due to malnutrition, to deafness or to poor sight; that persistent wrong doing likewise is *sometimes* the result of bad nutrition or of a diseased or injured brain; and finally, that death itself, is absolutely necessary to the continuance upon the earth of life as we know it. If living beings are to have the power to propagate their kind, without death there would be neither space nor food for all the millions on millions that have inhabited the earth since "first the flight of years began." And when the student of biology can trace in his imagination the evolution of life from primordial slime to the brain of a Darwin, trace it with all its blind groping, its instinctive striving, and see it emerge at a level where it can ally itself with that same creative power which directed it on the upward, million-year-long journey, and can do something to modify its own future destiny upon the earth, does that not give perspective, does that not give "imaginative insight into human life?" If it does then science is justified in its claims to cultural value.

Do not understand me to believe that all these values can come in full measure to pupils in the first year of the high school, but even those pupils can be taught some of the things which are fundamental in the attainment of these values.

I have tried to point out some of the principles upon which, in my opinion, a successful course in botany must be based, to indicate what phases of it are most illuminating, and give the best insight into the life of

plants, whether they are viewed merely as vegetation, as doers of the world's work, or as contributors to the necessity and enjoyment of man. I have not laid out a new course, but have only pointed out where in our old courses the emphasis should be placed in order to serve best both pure science and practical life, especially but not exclusively that phase of practical life exemplified in agriculture. I have not indicated in details, but only in general what the course should contain, and would not mean to imply that nothing should be put in the course which is not here mentioned. Perhaps every teacher will think of topics not mentioned here that might be added to advantage. The only question I should ask is this: Is there time to do that in addition to the more fundamental things? To cite a specific case, I have not put in the outline a study of types of Bryophyts, Pteridotphytes and Spermatophytes to show the progress of evolution from the lower to the higher plants. My main reason for omitting it, is a doubt whether high school students, especially those of the first year, are sufficiently mature to see adequately the significance of such a series of types. I am assured by some excellent high school teachers of botany that they teach that phase of the course with a reasonable degree of satisfaction to themselves and of illumination to their students. To such I should say, "Keep on." Certain it is that nowhere else in botany and perhaps nowhere else in the whole field of biology can equally valuable evidence for evolution be presented for first hand study in so little time and with material so easily accessible as in the series from Bryophytes to Spermatophytes. Nevertheless in a half year course with students in the first year of the high school I should not consider the course a failure because this phase of the subject was not included.

Let us recapitulate the main points made in the paper:

1. Educationally science as method is of more value than science as subject matter. The distinctive feature of the scientific method is the determination of the truth of some of the primary facts of the science at first hand by every student, by observation or experiment, and drawing conclusions or making judgments upon them.

2. The criticism of science courses that they lack continuity, interdependence and organization has some validity, yet there is a continuity commonly overlooked, namely the continuity of method, and the continuity of the laws of nature which are common to the different sciences.

3. Still further continuity and better organization are possible using agriculture as the center of organization. This makes the contact of pure science with life, thus meeting the demand that education should be more practical. It also gives the opportunity to carry over or transfer the discipline of pure science, that is, its method, into the field of applied science. It is perhaps only when a method is consciously carried over into another field that the formal discipline of a subject attains a general value.

4. The Spermatophytes, and the fungi, yeasts and bacteria are the

plants most important both for a knowledge of the part plants play in the work of the world, and in their relations to man directly.

5. Both structure and physiology should be studied, but the use of the compound microscope should be reduced to a minimum.

In understanding the part plants play in the world, and for the control of plant production a knowledge of physiology is more illuminating than a knowledge of structure. Structure is more easily used in laboratory work in training in exact observation, but physiological experiment offers most excellent opportunity to draw logical conclusions from observed facts. From the point of view of scientific methods, the experiment is more valuable than mere observation, since it leads to the formation of judgments from a set of facts brought to bear on the solution of a given problem, or on the answer to a given question. The physiology and the structure of a given organ should be studied together.

6. The main structural features of leaf, stem, root, flower, seed and fruit should be studied, with the chief differences between monocotyledonous and dictoyledonous plants. Some observation should be made on the finer details of the cell, protoplasm, cell wall, nucleus, chlorophyll bodies; the cells concerned in feltilization, the pollen grain and the pollen tube, with their contents and the embryo sac; some work should be done on the morphology of the bacteria, yeasts and fungi.

7. On the physiological side a knowledge of the water relations of plants, together with a knowledge of the nutrition of plants as related to soil fertility, probably gives the most control over crop production. How plants absorb, transport, and lose water, the amount necessary, available water in the soil and its conservation, are the leading ideas concerning the water relation. A knowledge of photosynthesis shows the place the green plants occupy in nature, as the energy storers and food manufacturers. A knowledge of foods in general, their kinds, their sources and their uses, illuminates one of the most important relations of plants to human life, and shows one of the fundamental similarities of all living things.

Growth and the condition necessary for it, especially the temperature and moisture relations, the oxygen requirements and the food supply should be studied. A study of the raw materials out of which the food is made may lead to an understanding of soil fertility and the requirements for soil fertilizers. The last should be demonstrated by some experiments.

Some study should be made of the responses to stimuli by which plants adjust themselves to their environment, especially the responses to light and gravitation.

8. The physiology of bacteria, yeasts and molds should be demonstrated by experiments, and these should be supplemented by reading a good text book. I would suggest the following subjects for experiment: The distribution of bacteria and fungi in air, water, dust, earth, and food (milk, bread, etc.). Their effect in putrefaction, and in fermentation, as the spoil-

ing of cooked peas, the souring of milk, the alcoholic and acetic acid fermentations, the making of bread;

Their necessity for organic food, as shown by the amount of growth with and without organic matter, contrasted with the capacity of green plants to make their organic food;

Their temperature relations, minimum temperature for growth, and its relation to preservation of food in cold storage, the optimum temperature for growth and its relation to the rapidity with which food spoils in summer, the thermal death point, and its relation to sterilization and pasteurization of milk, the preservation of other foods, or to making suspected drinking water safe; the fixation of nitrogen in root tubercles on leguminous plants, showing the difference when grown in soil with and without the nitrogen fixing bacteria;

The study of a few plant diseases produced by fungi or bacteria, as the rust of wheat, of the hollyhock, or of the carnation, the mildew of some common plant, the brown rot of plums or peaches, the scab of apples, some leaf spot diseases, the smut of oats or corn, the fire blight of the pear, the crown gall or knot of fruit and other trees, or whatever material is readily available.

Some of this last material might be kept as a permanent stock by mounting it under celluloid. Few of the text books for high schools give experiments with the bacteria. Bigelow's "Applied Biology" gives some good ones for molds and yeasts.

9. Every course in botany should include some acquaintance with plants out of doors. Either in the woods and fields, or along the streets and in the parks, or even in vacant city lots and about homes. The knowledge that is most valuable here is that which enables one to recognize species of trees, shrubs, or flowers as acquaintances or friends, rather than to have a definite number of pressed specimens all labeled with complete classification, or full technical descriptions in note books. Students who feel an interest in the latter sort of work may be encouraged to do it for themselves, but it is not the most valuable knowledge to be required of all. This work should be carried out largely for its recreative value to the average individual. It might profitably include a knowledge of weeds, of common cultivated plants, of trees and shrubs commonly used for ornament, as well as a knowledge of plants growing in woods and fields. It should include the recognition of those characteristics which make the plants undesirable, or desirable for the uses to which they are put. Excursions, though only around the block to get acquainted with the trees planted along the street, may be made the basis of teaching, of testing and of drill exercises. The sort of knowledge desired comes only with frequently repeated observations of the same species.

In the relations of plants to their environment, both organic and inorganic, various ecological observations may be made. The struggle for ex-

istence among weeds in a vacant lot or of weeds and crops in a cultivated field, may offer convenient material. In many ecological problems the work must as yet be largely observation, with little in the way of conclusion or general law. Methods of seed distribution, of pollination, observation of plant associations, and of plant successions, are a few of the ecological problems that may be studied in the field if the situation is favorable.

PHYSIOGRAPHY CONFERENCE

FIELD METHODS OF GLACIAL GEOLOGY.

FRANK LEVERETT, GEOLOGIST, U. S. GEOLOGICAL SURVEY, ANN ARBOR.

In the early and middle part of the 19th century the attention of field geologists interested in glacial features was directed largely to the question of the extent of the drift and evidence as to its mode of deposition, whether by floating ice or by land ice. The presence of buried soils was noted at an early date but was not recognized at first as evidence of repeated glaciation; instead it was cited as an evidence against land ice and in favor of iceberg deposition, for it was argued that land ice should have torn up all the old soil it overrode. The loess deposit which overlies a considerable part of the drift was early cited in favor of extensive submergence, though now it has come to be generally regarded as a wind deposit.

Not until the latter part of the century, when Chamberlin, Gilbert, McGee, N. H. Winchell, Upham, and others began systematic work on the drift, were moraines and other land ice features clearly recognized and the iceberg hypothesis effectually displaced. The evidence for successive glacial stages was also brought into clear recognition. Following this and largely through investigations by the Canadian Geological Survey, it became known that the ice had more than one center of dispersion. This was known for the last stage of glaciation and inferred for earlier stages. The location of ice in the great valleys, early brought to notice by Chamberlin, was soon seen to give rise to a complex lake history, to which Upham, Gilbert, Taylor, Spencer, and others had contributed important chapters by the end of the century.

It is fortunate that the glacial investigations by the United States Geological Survey were from the beginning directed by one with so broad a grasp of this intricate subject as is possessed by T. C. Chamberlin. Having made a general reconnaissance from the Rocky Mountains to the Atlantic seaboard prior to his connection with the Federal Survey, he at once outlined plans for a comprehensive mapping and study of the leading features

of the glacial deposits of the entire field. By this method the knowledge of our glacial deposits has grown symmetrically and there has been a rapid unfolding of the leading events or episodes of glacial history. In this work several of the State geologists have been in close touch with Chamberlin and have consulted with him as to methods and plans. Work done under the auspices of universities and colleges has also been brought into the same general plan. As a result there is already worked out a somewhat complete outline of glacial stages and an extensive mapping of moraines and other features for the large glacial area of northeastern United States. The subject is now advanced to such a stage that detailed areal study and mapping can be taken up and the results interpreted in relation to the broad questions and problems as well as to local ones.

In the development of North American glaciology under Chamberlin a number of cognate questions of economic value have been given atention; such for example as the relation of soil distribution to glacial history; the distribution of plant societies in relation to various types of glacial deposits and their proper successors in cultivated crops; the occurrence of underground waters and availability of such waters for public and domestic use; also locations and surroundings of valuable water powers due to glaciation. So also have questions of more purely scientific nature, such as changes of drainage and peculiarities of drainage development due to glaciation; recent uplift of parts of the glaciated region as shown by the inclination or warping of the shore lines of the glacial lakes, and the bearing of these on questions of the effect of ice weighting, and ice attraction; the rate of recession of water falls and excavation of valleys in their bearing upon the length of post-glacial time, and numerous other scientific matters of more or less consequence.

As outlined by Chamberlain the glacial investigations embrace a careful mapping of all moraines, outwash plains, lines of glacial drainage, eskers, kames, drumlins, and intermorainic till tracts, and all other features necessary to a complete general exhibit on a map of the structure and topography of the drift. It also embraces a study of natural and artificial exposures, of well records, and all available material bearing upon the succession of glacial formations.

In the areas covered by glacial lake waters they embrace a study of the several shore lines and their relations to lake outlets and also their relation to the ice sheet and its oscillating border; the lacustrine deposits over the entire lake areas are also studied sufficiently to show the extent of each of the leading types of soil. Inasmuch as earth warping or differential uplift has affected the shore lines of a considerable part of the lake areas the amount of tilting of each beach is more or less carefully studied in order to fix upon the time when uplift began, when it was most rapid, and in what directions the tilt lines trend. This study alone embraces hundreds or even thousands of miles of travel and a large amount of careful leveling to prop-

erly interpret the nature of the uplift, its geologic relations, and time relations.

One of the first essentials to correct interpretations in glacial studies is the preparation of a complete map on the ground. It is not sufficient to note the width of a certain kind of deposit, where it is crossed by the lines traversed in the field, and then make up a map in the office, although such has been the practice of a number of glacial students. Such a map made up in the office is certain to be far less accurate than one on which the extent of each deposit is carefully noted in the field.

In the field one is often forced to draw upon every available line of evidence to support his mapping, because of the incompleteness of the exposures. Were the glacial geologist to publish merely an exhibit of what is shown in outcrop, as is frequently done by the stratigrapher, the map would be wholly unintelligiblee to persons not familiar with the particular field, even if somewhat well trained in glacial investigations. It is very necessary to determine the general drift structure in order to make an intelligible map. To do this in the absence of exposures the glacialist watches for every indication of a change of drift structure, in changes of the vegetation or character of crops, as well as in the materials brought up by burrowing animals. Constant inquiry of residents as to the soil and its relations to common crops must be kept up, and knowledge obtained of borings or excavations of all classes that have been made along or near the line of route. There is thus no opportunity for the glacialist to become absorbed in meditation or otherwise preoccupied unless he stops on his trail. He must too, with each change in drift structure, be alert in mind and ready to furnish an interpretation of the cause of change. Otherwise, the map will become a piece of uninteresting routine work that may soon become tedious and even fatiguing.

The mapping of boundaries between different classes of glacial topography and between different kinds of drift with similar topography is done by methods adapted to each feature or deposit. In tracing the course and the limits of such a strong topographic feature as a moraine, it is hardly necessary to leave the wagonroad, the mapping being easily done on topographic maps; while in the absence of such maps distance from section lines, streams, or other ordinary map features may be readily estimated. If a moraine is but a mile or so in width both borders may be traced in a single traverse by a zigzag course along it; but if several miles in width each border and also the crest may require separate tracing; the moraine is also usually crossed at intervals sufficiently frequent to familiarize one with the variations in expression.

The beach lines of the glacial lakes and to some extent the eskers must be followed at close range to insure correct mapping. Topographic maps are especially useful in giving these linear features their correct position. The same is true of drumlins and kames.

The borders between gravel plains and till plains are usually traced by noting either a change in topography or change in vegetation, supplemented, of course, by such exposures as are to be found.

It is the writer's custom to record data successively as collected in the field without attempt to put them under separate subjects, for much time is ordinarily lost and much inconvenience experienced in making such a separation or grouping while on the trail, especially if it is through fields or brush. At the close of each day an index of the main features observed is entered on the fly-leaf of the notebook, so that when the notebook is filled one has an abstract of the notes contained therein. Then at the close of the field season, the areas and subjects embraced in each note-book are put in a catalogue of the notebooks. By this method the writer is able in five minutes time to find any item entered in any of the 250 notebooks he has filled since he began field work. On the field maps marginal references are frequently made to the notebooks which contain the principal geologic data, and as much data as can conveniently be placed on the map is entered there as well as in the notebooks.

In the writer's practice mapping in the field is by a system of colors supplemented to some extent by conventions. The colors adopted have been such as to make strong topographic features stand out prominently, while plains are represented in duller colors. Several of the glacialists have come to adopt the same system of colors and this is a great advantage in reading each other's maps. This system has been elaborated sufficiently to bring out drift structure as well as topography. For example, for topography a moraine is given a red color, an outwash gravel plain a brown color, and a till plain a blue color, while for structure the gravelly part of a moraine has a brown color rubbed over the red, while the clayey part has a blue color over the red. One can thus read from the map the change from clayey to gravelly moraine in the absence of notes of any sort on the map.

Inasmuch as flowing wells are of high economic value, the field maps are made to show areas in which they may be obtained. Marl, peat, and other features when thought to be of commercial value are indicated on the maps and notes are made as to the value of certain classes of soil for certain products, and so forth. Rock outcrops, glacial striae, the course of buried channels, and other features of importance are also noted on the map.

It is the writer's habit to enter in the notebook a brief running description of features noted rather than a mere jotting down of data sufficient to call up the situation. This has been found necessary, not only to render the notebooks intelligible to others, but to insure a correct personal understanding after the lapse of years when the memory can no longer recall the full situation.

Observation needs to be carried along so many lines in the present-day glacial investigations that it is becoming difficult for a beginner to take up the work, and there is a tendency to restrict himself to lines for which

he has a special aptitude. One man may be best in mapping moraines and other topographic features but not able to satisfactorily interpret differences in the rock constituents of superposed drift sheets. Another may be quick to see differences in rocks but not in topography. Neither of them may be able to use the criteria from vegetation successfully in the absence of natural exposures. It is also found necessary at times to make maps of important topographic features, so that a man with some engineering skill becomes a valuable member of the field force. These facts and the fact that the beginner is encouraged to keep up the work if he realizes he has an aptitude for it, makes it of some consequence in arranging a field party to select men of various tastes and capabilities, especially if a wide range of phenomena are open to study.

It is doubtful whether any line of geologic investigation requires more constant exercise of both the observational and the imaginative faculties of the mind than the mapping of glacial features. The great areas involved in the broader elements of the interpretation also require long continued holding in abeyance of final conclusions. In the writer's experience there are subjects that have been held tentatively for years, some that are still held tentatively after over a quarter century of study, because the field studied is not yet wide enough to clear up their history and relations.

PROGRESS OF THE TOPOGRAPHIC SURVEY IN MICHIGAN.

An Abstract from the "Biennial Report of the Director of the Geological and Biological Survey of Michigan."

MR. R. C. ALLEN, DIRECTOR.

The ultimate aim of the topographical survey is the mapping of the entire area of the state, 57,980 square miles, in units of 15′ of latitude and 15′ of longitude, each unit being issued as a separate sheet on a scale of 1:62500, with a vertical contour interval of twenty feet, except for special areas such as state forests, state military reservations, certain mining districts, etc., where for special reasons a small vertical interval and a larger scale may be more desirable. The topographic mapping of Michigan is contributory to the completion of a topographic map of the entire United States and its dependencies. More than two-fifths of the entire country is now topographically mapped.

The work is being carried forward from year to year by the U. S. Geological Survey largely in co-operation with the various states. Co-operation in topographic mapping with the United States Survey was commenced in the state of Michigan in 1901, when an allotment for such work

was made by the director of the U. S. Survey. Up to June 30, 1911, there has been mapped 5,117 square miles in the state of Michigan, this being about 9% of the entire area of the state. Of this 3,530 square miles are located in the southern part of the state. The resultant maps of this area published on a scale of 1:62,500 were made under the topographic standards now in force and are in such detail as to satisfy the engineering, geologic, and economic needs of this portion of the state. Much of the area mapped in the Northern Peninsula is classified as reconnaissance on the maps of that country with the exception of the Marquette, Calumet Special and Menominee Special sheets.

Practically all the quadrangles in the Southern Peninsula were surveyed through co-operative arrangement between the Federal Survey and the Geological Survey of Michigan, but the amount of such co-operation has been small on each side and only sufficient to complete little more than one quadrangle a year.

USEFULNESS OF TOPOGRAPHICAL MAPS.

More than two-fifths of the area of the United States is already topographically mapped. In five states the topographic map is completed, in six others over 70% is finished, five have mapped between 50% and 65%, five between 40% and 50%, and eight between 30% and 40% of their areas. Topographic maps of every state in the union are being made. It is not to be supposed that governments would engage continuously in work of this nature were the results not generally regarded as useful, but in order to answer in some detail the question "Of what use are topographic maps?" there is given below some of the main uses which are being made of these maps.

1. As preliminary maps for planning extensive irrigation and drainage projects, showing areas of catchment for water supply, location of water brine, oil and gas wells, sites for reservoirs, route of canals, etc.
2. For laying out highways, electric roads, railroads, aqueducts, and sewage systems, thus saving the cost of preliminary surveys.
3. For improving rivers and smaller waterways.
4. In determining and classifying water resources, both surface and underground.
5. In the problem of the most feasible and economical selection of water supply for cities.
6. In making plans for the disposal of city sewage, garbage, etc.
7. In determining routes, mileage, location of road building material, and topography in country traversed by public highways.
8. In selecting the best routes for automobiling tours and inter-city runs.
9. As guide maps for prospectors and others travelling through little known regions.

10. As bases for the compilation of maps showing the extent and character of forest and grazing lands.

11. In classifying lands and plotting the nature and description of soils.

12. In compiling maps in connection with the survey and sale of lands.

13. In making investigations for the improvement of plant nad animal industries, and in a comprehensive study of physical and biological conditions in connection with the stocking of interior water with good fish and the locating of fish culture stations.

14. In locating and mapping the boundries of life and crop zones, and in mapping the geographic distribution of plants and animals.

15. In plotting the distribution and spread of injurious insects and germs.

16. As a base map for plotting of information relative to the geology and mineral resorces of the country.

17. In manœuvers of the national guard, in the development of military problems and the selection of routes for road marches or strategical movements of the troops, particularly of artillery or cavalry.

18. In connection with questions relating to state, county and town boundaries.

19. As a means of promoting an exact knowledge of the country and serving teachers and pupils in geographic studies.

20. As base maps for the graphic representation of all facts relating to population, industries, and products and other statistical information.

21. In connection with legislation involving the granting of charters, rights, etc., when a physical knowledge of the country may be desirable or necessary.

SOME COMPARISONS.

It was stated above that only 9% of the area of Michigan has been topographically mapped. The percentage for the entire country exceeds forty. We are thus about 31% behind the country at large. Of the 48 states in the union Michigan ranks forty-forth in the percentage of area surveyed. That Michigan has fallen so far behind is mainly due to her failure to take fuller advantage of the plan of co-operation offered by the Federal government. The Federal Survey offers to meet dollar for dollar, up to a reasonable limit, any appropriation the various states may make for topographic mapping. Many states have taken full advantage of this offer and others have even gone farther and have offered more money than the Federal government could meet. In comparison with the neighboring state of Ohio, for instance, Michigan allotments for co-operation seem insignificant. (Ohio state appropriation for 1911-12 was $25,000, Federal appropriation for Ohio for 1910-11, $15,000; Michigan state appropriation for 1910-11 was $2,000, and the Federal appropriation for Michigan was $2,000). The results of the liberal policy in Ohio are apparent when one

realizes that the entire area of the state will be covered by modern topographic maps within the next four or five years and that more than 70% of the state has been completely mapped.

DOES MICHIGAN NEED A TOPOGRAPHIC MAP?

I have enumerated 21 uses which are made of topographic maps. There are other uses which are not mentioned. Each of these constitute a *reason* why there should be a topographic map of Michigan. But appeal should be stronger in Michigan than in many other states. Large areas in the northern part of this state await development. Is it not obvious that a good map is the very best aid to the development and settlement of *any* region? Appeals for maps are made to this department every day in the year, more than half of them from sources outside the state. But we have to face the fact that no accurate maps of 90% of our area have ever been made.

Now suppose the state were in a position to furnish to each of the thousands of home seekers who make inquiry in Michigan each year, maps at five cents per copy showing the exact character of the surface of the country of which inquiry is made,—the "lay of the land" shown more accurately than any photograph could show it,—and suppose there were shown on the same map or other maps the general character of the soils,—would not such information return to the state in dollars and cents many times the cost of providing it?

Such maps are not only essential to the home seeker but in every legitimate purpose of development. I say *legitimate purpose* for the reason that there have been and are now being perpetrated schemes of so-called "development" of lands in the state which are conceived in fraud and executed under cover of a lack of a source of readily available trustworthy information, thus permitting the successful dissemination of gross misinformation and misrepresentation. The pernicious misadvertisement of some lean parts of the state negatives to a considerable degree the work of the various development bureaus composed of citizens who are engaged in legitimate advertising and are annually spending large sums of money for industrial development.

SOIL MAPS.

As to the usefulness of trustworthy maps I would call attenion to the general soil maps of the state recently issued by this department. The general opinion of the economic value of these maps is illustrated by the action of the Development Bureau of the Northern Peninsula which had printed for use in advertising the agricultural advantages of that part of the state an edition of 60,000 copies. I might mention also that the Board of State Auditors had printed a special edition of 20,000 copies for the use of the Commissioner of Immigration.

Now good topographical maps are just as essential and valuable, if

not more so, than these general maps of the surface or soil formations have proven to be and there can be no doubt that public expenditures for them are more than justified by the results that follow. This is proven by the results in the state so far as we have gone and is evidenced by the rate at which the work is going forward in all parts of the country and in some states in particular. Now the point which I would make is that Michigan can well afford to take much fuller advantage of the liberal offer of co-operation which is made by the Federal government and appropriate much more liberally for this purpose than heretofore.

WHAT IS THE COST OF TOPOGRAPHIC MAPS?

The cost of topographic maps varies with the character of the country. An open country well dissected by roads is mapped with less cost per square mile than a wooded or undeveloped country. The cost of the work in the Southern Peninsula has been approximately $10.00 per square mile or 1½ cents per acre. In the nine years that the work has been carried on the state has spent $17,800 and the Federal government approximately the same amount. Thus an approximate total of $35,600.00 has been sufficient for the mapping of 3,530 square miles and in addition control lines have been run for a considerable number of quadrangles which have not been mapped. It it probable that the cost would be materially reduced were the operations conducted on a larger scale.

IS THERE A PUBLIC DEMAND IN MICHIGAN FOR TOPOGRAPHIC MAPS?

Informal requests for topographic maps are being received from almost everywhere in the state,—particularly from the more undeveloped parts of the state. Occasionally such requests are presented as formal petitions.... There has been received from the Adjutant General a request for a topographic map of the proposed new military reservation in Crawford county and from the Public Domain Commission a request for topographic maps of the Houghton Lake and Higgins Lake State Forests.

PLANS FOR TOPOGRAPHIC MAPPING.

It has been pointed out that the appropriations granted heretofore for co-operative topographic mapping in Michagan are so small that reasonable progress towards completion of a map of the state can not be made thereunder. The Federal government offers to co-operate with Michigan in this work up to any amount not to exceed twenty thousand dollars ($20,000) per annum. Provision has been made in the budget submitted for an acceptance of this co-operation to the extent of fifteen thousand dollars ($15,000) per annum. With an annual expenditure of $15,000 by the state progress could be made at the rate of 2,500 to 3,000 square miles or from 7

to 10 quadrangles per annum. Mapping of the state forests and the military reservation on a special large scale and ten foot vertical interval should be undertaken at once. The order of survey of the various quadrangles should be left to the discretion of the Board of Geological Survey to be governed by the relative urgency of the need of such work in the various parts of the state.

SYNOPSIS OF BUSINESS MEETING

April 4, 1912-1913.

Meeting called to order by President H. N. Chute. Report of Secretary read and approved. Report of Secretary-Treasurer and of Auditing Committee read and both accepted. Report of Legislative Committee read, accepted, and the Committee continued. Recommendation of Educational Committee that "Educational advantages should be offered to children of school age, who may be in attendance at the hospitals in connection with the University of Michigan, either as state cases or as private patients, and suggesting that the law of the State be amended so as to make the same possible" was endorsed.

Report of nominating committee was accepted and the persons therein named were declared elected to their respective offices.

Committee on Nominations.

Chairman—W. B. Arbaugh, Ypsilanti.
At Large—E. N. Worth, Kalamazoo, and L. P. Jocelyn, Ann Arbor.
Classical Conference—A. B. Crittenden, University.
Modern Language Conference—R. C. Ford, Normal College.
English Conference—B. F. Comfort, Detroit Cass.
History Conference—W. B. Sloan, Bay City.
Physics and Chemistry Conference—R. H. Struble, Detroit Eastern.
Mathematics Conference—Miss M. S. Gerls, Detroit Central.
Biology Conference—LeRoy Harvey, Western Normal.
Commercial Conference—W. A. Morse, Detroit Western.
Physiology Conference—J. D. Scott, University.
Drawing Conference—G. J. Bennett, Muskegon.
Manual Training Conference—J. B. Davis, Grand Rapids.
Educational Psychology Conference—C. G. Wade, Flint.

Auditing Committee.

A. G. Hall, University, and E. E. Gallup, Adrian.

Committee on Legislation.

D. W. Springer, Ann Arbor; E. A. Lyman, Normal College; C. F. Adams, Detroit Central; J. B. Edmundson, Jackson; W. G. Coburn, Battle Creek.

FINANCIAL REPORT OF SECRETARY-TREASURER, 1912-1913.

Receipts.

March	4	Balance as per last report, commercial Dept.	$ 190 08
		Balance as per last report, savings Dept.	27 74
March	22	Deposit	39 00
March	28	"	225 00
March	30	"	328 70
April	5	"	61 30
May	11	"	3 00
May	20	"	61 00
June	21	"	70 00
July	19	"	32 80
July	31	"	10 00
Dec	27	"	1 00
		Total	$1049 62

Disbursements

1912					
March	13	Check No	220	H. G. Prettyman, Postage	$ 20 00
March	14	" "	221	E. E. Calkins, postage	5 00
March	29	" "	222	J. R. Thomas, doorkeeper	0 45
March	29	" "	223	O. B. Thiel, doorkeeper	0 70
March	30	" "	224	Adah Baer, clerk	3 30
Apr.	2	" "	225	L. P. Jocelyn, salary	100 00
Apr.	2	" "	226	Nellie Easton, clerk	4 00
Apr.	2	" "	227	E. S. Loomis, Math. Conference	28 95
Apr.	2	" "	228	J. A. Muma, doorkeeper	1 95
Apr.	2	" "	229	W. S. Lezapski, doorkeeper	1 50
Apr.	9	" "	330	American Express Co.	0 70
Apr.	10	" "	331	H. G. Prettyman, postage	17 78
Apr.	16	" "	332	The Times News Co. Ads	2 20
Apr.	17	" "	333	C. J. Keyser, address	49 45
Apr.	17	" "	334	David Felmley, Address	20 68
Apr.	20	" "	335	William Hollands, doorkeeper	0 45
Apr.	29	" "	336	Roger Thomas, delivery	75
Apr.	30	" "	337	E. E. Calkins, postage	1 00
May	9	" "	338	E. E. Calkins, postage	2 00
May	11	" "	339	Clerical force for year	47 40
May	22	" "	340	S. W. Millard, badges, etc.	16 00
June	1	" "	341	Ann Arbor Press	392 52
June	6	" "	342	E. E. Calkins, postage	2 00
July	15	" "	343	Clara Inglis, list of rooms	1 10
July	15	" "	344	Geo. Wahr, cards	3 00
July	16	" "	345	E. E. Calkins, postage	2 00

1913					
Jan. 13	"	"	346	E. E. Calkins, postage	2 00
March 1	"	"	347	C. F. Meyers, printing	4 25
March 4	"	"	348	E. E. Calkins, postage	8 00
March 8	"	"	349	E. E. Calkins, postage	4 80
March 12	"	"	350	American Express, proceedings	10 84
March 19	"	"	351	E. E. Calkins, postage	20 00
March 19	"	"	352	Ann Arbor Press, printing	200 00
March 22	"	"	353	E. E. Calkins, postage	3 00

Total	$ 977 77
Total receipts	$1049 62
Total disbursements	977 77
Balance, March 24	$ 71 85
Balance in Savings Dept.	27 74
Bal in Commercial Dept.	44 11

April 4, 1913.

We, the undersigned, have examined the Financial Report of the Secretary-Treasurer of the Michigan Schoolmasters' Club, and find the same to be correct.

Auditing Committee.
ARTHUR G. HALL
E. E. GALLUP

Report of Nominating Committee.

Officers of the Club for 1913-14.

President—J. M. Frost, Muskegon.
Vice-President—Miss Gertrude Breed, Ann Arbor.
Secretary-Treasurer—L. P. Jocelyn, Ann Arbor.
Classical Conference—Chairman, Campbell Bonner, University; Secretary, Anna S. Jones, Grand Rapids.
Modern Language Conference—Chairman, J. H. Bacon, Kalamazoo; Secretary, Miss Anna Barnard, Central Normal.
Physics and Chemistry Conference—Chairman, F. S. Kedzie, M. A. C.; Vice-Chairman, D. L. Rich, University; Secretary, C. W. Greene, Albion College.
English Conference—Chairman, J. R. Brumm, University; Vice-Chairman, C. L. Spain, Detroit; Secretary, Edith W. Shaw, Ann Arbor.
History Conference—Chairman, W. A. Frayer, University; Secretary, Bessie L. Priddy, Adrain.
Mathematics Conference—Chairman, Albertus Darnell, Detroit; Secretary, W. H. Pearce, Normal College.
Biology Conference—Chairman, LeRoy Harvey, Western Normal; Secretary, Helen B. King, Saginaw.
Commercial Conference—Chairman, David Friday, University; Secretary,

Physiography Conference—Chairman, Frank Leverett, University; Secretary, C. B. Bowerman, Detroit.
Draiwng Conference—Chairman,
Secretary, Kate B. Conover, Detroit.
Manual Training Conference—Chairman, J. H. Trybon, Detroit; Secretary—open.
Educational Psychology Conference—Chairman, H. C. Lott, Normal College; Secretary, G. B. Randells, Alma College.

REPORT OF LEGISLATIVE COMMITTEE.

At its meeting last year, the Michigan School masters Club authorized the appointment of a Committee on legislation to co-operate with similar committees from other educational organizations. Two of our number were members of other committees and, being the last committee in the field, we awaited suggestions from the other committees as to ways in which we could be of service. As these did not come, we have done a little work on our own hook, acting however, largely as individuals rather than as a committee. Each of the members has spent at least one day at Lansing, and some of them many days, advising the various legislators that the Uniform Textbook Bill was not a panacea for educational ills. Three of the members of the committee have done considerable work in behalf of the teacher's retirement fund. Recently, there has come to the notice of the chairman of your committee the fact that there are annually in attendance in the hospitals connected with the University of Michigan over two hundred crippled children, who are of school age. These children are in the hospital for varying lengths of time, the average being about six weeks. About half of these children are here at state expense, under Act No. 42, of the public acts of Michigan, 1897. During the time children are at the hospital, they are in such physical condition that from one-half to three-quarters of their stay they could attend to school matters if educational advantages were offered them. Many of these children are already in the public schools of the state and the time when they are in the hospital represents a period of absence from school and a consequent loss of school training. With a slightly added expense, educational advantages might be offered them, and I suggest that it would be within the province of the Schoolmsters' Club to pass a resolution endorsing the general principle that educational advantages should be offered to children of school age, who may be in attendance upon the hospitals, either as state cases or as private patients, and suggesting that the law be amended to make the same possible.

D. W. Springer,
Chairman.

The meeting adjourned.

Louis P. Jocelyn, Secretary.

PROGRAM OF GENERAL SESSIONS

(Admission to *all* meetings of the Club by badge).

Wednesday Evening, April 2

7:00 o'clock

ROOM B-8, HIGH SCHOOL

Meeting of the Association of High School Principals
Chairman—Principal J. B. Edmonson, Jackson.
Secretary—Principal J. E. Porter, Cadillic.

1. Informal Discussion of Administrative Work of the High School.

8:00 o'clock.

PHYSICS LECTURE ROOM

Address: A Botanist's Travels in Mexico.
Dr. C. J. Chamberlain, Professor of Botany, University of Chicago. (Compliments of the Academy of Science).

Thursday Morning, April 3

9:30 o'clock

UNIVERSITY HALL

President—Mr. H. N. Chute, Ann Arbor.
Secretary—Mr. Louis P. Jocelyn, Ann Arbor.

1. High School Biological Sciences as Related to Human Life.
Prof. Maurice A. Bigelow, Teachers College, Columbia University, New York City.

2. A Report on a Study of Science in High Schools.
Dr. J. G. Coulter, Bloomington, Illinois.

Thursday Afternoon

4:00 o'clock

BARBOUR GYMNASIUM

1. Junior Girls' Play, 4:00 P. M.
2. Reception of Alumnæ and former Students of the University, 6:00 P. M.
3. Alumnæ Banquet, 6:45 P. M.

(Note:—Admission to Play and Banquet $1.00. Secure Reservations before April 2 of Dean Myra B. Jordan).

4:15 o'clock

LECTURE ROOM, 203 TAPPAN HALL

Presiding Officer—President H. B. Hutchins.

Illustrated Lecture, The Industrial Arts of the Ancient Orient. Professor Karl Bezold, University of Heidelberg, Germany.

Thursday Evening, April 3

8:00 o'clock

UNIVERSITY HALL

Address, Sound Waves. How to Photograph and Analyze Them, Professor Dayton C. Miller, Case School, Cleveland, Ohio.

8:00 o'clock

(Admission by badge).

MUSICAL PROGRAM—HIGH SCHOOL

Under the auspices of the University School of Music.

Friday Morning, April 4

8:30 o'clock

UNIVERSITY HALL

(Admission to *all* meetings of the Club by badge).

BUSINESS MEETING OF GENERAL SESSION.

President—Mr. H. N. Chute, Ann Arbor.
Secretary—Mr. Louis P. Jocelyn, Ann Arbor.

(a) Reports of Officers.
(b) Reports of Committees.
(c) General Business.
(d) Remarks and Reccommendations of the President of the Club.

9:00 o'clock

LITERARY MEETING OF GENERAL SESSION

1. The Function of the High School,
   Hon. Luther L. Wright, Superintendent of Public Instruction.
2. Social Origins of the School,
   Professor R. M. Wenley, University of Michigan.
3. The Product of the High School,
   Professor J. L. Markley, University of Michigan.
4. Discussion.

Friday Afternoon

4:00 o'clock

ROOM C-1, HIGH SCHOOL

Michigan State Federation of Teachers' Clubs.

Chairman—Miss Euretta Bannister, Grand Rapids.
Secretary—Miss Margaret Strahn, Grand Rapids.
Meeting of the Board of Directors and all members.

4:15 o'clock

SARAH CASWELL ANGELL HALL

Presiding Officer—Dean J. R. Effinger, University of Michigan.
Illustrated Lecture, The Religious Art of the Ancient Orient.

Thursday and Friday Evenings

7:00-8:00 o'clock

Informal Reception, Michigan Union.
Chairman of Reception Committee, Professor W. W. Florer.

(The Michigan Union will be pleased to serve meals to a limited number of teachers during the meeting.)

Friday Evening, April 4

8:00 o'clock

SARAH CASWELL ANGELL HALL

Presiding Officer—Professor F. W. Kelsey, University of Michigan.

Address: The Paradox of Oxford, Mr. Paul E. More, Editor of The Nation, New York.

PROGRAM OF CONFERENCES

CLASSICAL CONFERENCE

Chairman—Professor Campbell Bonner, University of Michigan.
Secretary—Miss Anna S. Jones, Grand Rapids.

Wednesday Afternoon, April 2

2:00 o'clock

LECTURE ROOM, 203 TAPPAN HALL

Presiding Officer—Professor Campbell Bonner, University of Michigan.

1. The Transition from the Roman System of Dating to the Modern System,
   Professor Mark Bailey, Kalamazoo College.
2. Solving the Problem of Secondary Latin,
   Conference conducted by Miss Clara J. Allison, Hastings High School.
   The following questions will be discussed:
   a Radical Changes in Subject Matter: a Venture and a Query,
   Miss Olive Sutherland, Eastern High School, Detroit.
   b Subordinating Quantity to Quality,
   Miss Elsie E. Cooper, Ypsilanti High School.
   c More Class Periods for Beginners,
   Superintendent M. W. Longman, Owosso.
3. Caesar B. G. VI. 26 Again.
   Professor Francis W. Kelsey, University of Michigan.
4. Roman Ruins in Timgad,*
   Professor Wallace S. Elden, Ohio State University.
5. Business Meeting.

Thursday Afternoon, April 3

2:00 o'clock

LECTURE ROOM, 203 TAPPAN HALL

Presiding Officer—Professor John T. Ewing, Alma College.

6. The Substantive Subjunctive,
   Professor Earle M. Parker, Northern State Normal School, Marquette.
7. Greek and Latin in the Schools of Belgium: a Report,
   Professor John G. Winter, University of Michigan.

* Illustrated with stereopticon.

8. Luther's Use of the New Testament in Latin before December, 1522,
   Professor W. W. Florer, University of Michigan, assisted by Miss Clara D. Meyer, Bessemer High School.
9. Some Thoughts about the Value of the Classics,
   Professor Moritz Levi, University of Michigan

4:15 o'clock
LECTURE ROOM, 203 TAPPAN HALL
University Lecture

Presiding Officer—President H. B. Hutchins.

10. The Industrial Arts of the Ancient Orient,*
    Professor Karl Bezold, University of Heidelberg.

Friday Afternoon, April 4

2:00 o'clock
SARAH CASWELL ANGELL HALL

Presiding Officer—Professor B. L. D'Ooge, State Normal College

11. The Material Bond Between the God and the Worshipper,
    Professor Campbell Bonner, University of Michigan.
12. Informal "Round Table" Conference and "Question Box."
    Conducted by Miss Anna S. Jones, Central High School, Grand Rapids.

Special reports:

a Keeping Greek in the Schools,
Miss Winifred Daboll, St. John's High School.

b An Experiment with the "Direct Method,"
Dr. Frank E. Robbins, University of Michigan.

Note: Other questions for discussion at this conference should be sent to Miss Jones by April 1.

13. What Recent Books and Illustrative Materials are of Value for Classical Teachers?
    Informal descriptions and demonstrations by members of the classical faculty of the University of Michigan, Professors A. R. Crittenden and J. G. Winter leading.

4:15 o'clock
University Lecture
SARAH CASWELL ANGELL HALL

Presiding Officer—Dean J. R. Effinger.

14. The Religious Art of the Ancient Orient,*
    Professor Karl Bezold, University of Heidelberg.

* Illustrated with stereopticon.

Friday Evening, April 4

8:00 o'clock

SARAH CASWELL ANGELL HALL

Address before the Schoolmasters' Club.

15. The Paradox of Oxford,
Mr. Paul Elmer More, Editor of the Nation, New York.

MODERN LANGUAGE CONFERENCE

(Admission by badge).

Chairman—Professor Frederick Lutz, Albion College.
Secretary—Miss Martha Sturgis, Ann Arbor.

Wednesday Afternoon, April 2

2:30 o'clock

ROOM 203, UNIVERSITY HALL

Presiding Officer—Professor Frederick Lutz.

1. M. Henri Bordeaux,
Mr. William A. McLaughlin, University of Michigan.
2. Gottfried Keller's *Novellen* in the High Schools,
Professor John W. Scholl, University of Michigan.
3. A Trip into the Country of Mérimée's Columbia,
Professor Clyde B. Ford, Michigan State Normal College.

Thursday Afternoon, April 3

2:30 o'clock

ROOM 203, UNIVERSITY HALL.

Presiding Officer—Professor Max Winkler, University of Michigan.

1. Problems of Elementary Work in German,
Miss Mary McNerny, Ferris Institute, Big Rapids, Mich.
2. A New Talk on an Old Subject,
Miss Marie Haefliger, Alma College.
3. Charles Nodier as an Exponent of German Romanticism in France,
Professor J. H. Bacon, Kalamazoo College.

Friday Afternoon, April 4

2:30 o'clock

ROOM 203, UNIVERSITY HALL.

Presiding Officer—Professor Arthur G. Canfield, University of Michigan.

1. The Literary Art of Daudet,
Miss Bertha A. Williams, Flint, Mich.

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* Illustrated with stereopticon.

2. Composition Work in Modern Languages,
   Professor H. R. Brush, Hope College.
3. Herder's Ideals of Literary Criticism,
   Miss Miriam D. Goldman, Central High School, Detroit.

ENGLISH CONFERENCE
(Admission by badge).

Friday Afternoon, April 4

2:00 o'clock
AUDITORIUM, HIGH SCHOOL

Chairman—Assistant Principal E. L. Miller, Central High School, Detroit.
Secretary—Miss Caroline E. Britten, Jackson.

1. How much English should our boys and girls know when they enter the high school?
   Miss Clara Beverly, Supervisor of English in the Grammar Grades of Detroit.
2. What College Freshmen know about English when they arrive on the Campus.
   Mr. John R. Brumm, University of Michigan.
3. Discussion of the Above.
   Mr. W. M. Aiken, Head of the English Department of the Ann Arbor High School, Ann Arbor, Michigan.

HISTORY CONFERENCE
(Admission by badge).

Thursday Afternoon, April 3

1:45 o'clock
ROOM C-3, HIGH SCHOOL

Chairman—Mr. C. S. Larzelere, Central State Normal School, Mt. Pleasant.
Secretary—Mrs. Erie L. Gates, Bay City.

1. The Case of History in the High School,
   Miss Mary Fairman Power, Central High School, Detroit.
2. The Use of Sources in the Teaching of History,
   Professor Ernest A. Balch, Kalamazoo College, Kalamazoo.
3. The Function of the Elementary History Courses in the University,
   Mr. William A. Frayer, University of Michigan.

4. Round Table. Topic: The Relation of English History to American History in the High School Courses.
   Conducted by Principal N. B. Sloan, Eastern High School, Bay City.

Friday Afternoon, April 4

1:45 o'clock

ROOM C-3 HIGH SCHOOL

1. Some Thoughts on the Articulation of our History Courses,
   Miss Bessie Leach Priddy, High School, Adrian.
2. Political Science in History Teaching,
   Professor James E. Mitchell, Alma College.
3. The Highway with History,
   Professor Earl W. Dow, University of Michigan.
4. Round Table. Topic: How can History be made to Comply with the Modern Demand for a Utilitarian Education? Is this a Desirable Ideal?
   Conducted by Mr. W. H. Hathaway, Central High School, Grand Rapids.
5. Some Proposed Changes in the History Course,
   Mr. Geo. G. Bechtel, Detroit Central.

CONFERENCE OF PHYSICS AND CHEMISTRY

(Admission by badge).

Thursday Afternoon, April 3

2:00 o'clock

PHYSICAL LABORATORY, WEST LECTURE ROOM

Chairman—Professor N. H. Williams, University of Michigan.
Vice-Chairman—Mr. F. C. Irwin, Central High School, Detroit.
Secretary—Mr. B. E. Smith, Central High School, Grand Rapids.

1. Electric Waves and Their Measurement,
   Mr. D. L. Rich, University.
2. A Laboratory Method of Determining the Atomic Mass of Zinc,
   Mr. O. Tatlock, Detroit Central.
4. (a) A Simple and Effective Apparatus for Boyle's Law,
   (b) A Self-filling Barometer Tube and Manometer,
   (c) A Self-starting Siphon,
   Professor F. R. Gorton, Normal College.
5. The Preparation and Properties of Permanently Liquid Sulphur Trioxide,
   Professor D. M. Litchy, University.

6. The Place of the Electron Theory in Elementary Teaching,
   Professor K. E. Guthe, University.
7. What the Science Teacher May Do to Help the Prohibition of the Adulteration of Food and Drugs,
   Professor B. W. Peet, Normal College.

8:00 o'clock

UNIVERSITY HALL

8. Lecture on Sound,
   Professor D. C. Miller, Case Scientific School.

Friday Afternoon

2:00 o'clock

9. Business Meeting.
10. The Relation of a High School Science Teacher to Instruction in Agriculture,
    Professor Frank S. Kedzie, Michigan Agricultural College.
11. A Hand Winch for Laboratory Measurements,
    Mr. C. F. Adams, Detroit Central.
12. A Theory of Snow Crystal Formation,
    Professor J. C. Shedd, Olivet College.
13. Adaptation of the Teaching of Chemistry to Vocational Subjects,
    Professor Delos Fall, Albion College.
14. Some Experiments in Light,
    Mr. H. N. Chute, Ann Arbor High School.
15. Volume and Pressure Changes in a Typical Sound Wave,
    Mr. W. W. Sleator, University.
16. A Miniature Gas Plant,
    Mr. R. C. Josenhans, Jackson.
17. (a) An Application of Boyle's Law,
    (b) Index of Refraction,
    Mr. R. H. Struble, Eastern High School, Detrot.

MATHEMATICAL CONFERENCE

(Admission by badge)

Friday Afternoon, April 4

1:45 o'clock

TAPPAN HALL

Chairman—Mr. Alburtus Darnell, Detroit.
Secretary—Professor W. H. Pearce, State Normal College.

1. A List of Books for High School Teachers, with Comments,
   Professor W. W. Beman, University.

2. Revolving Vectors,
   Professor G. W. Patterson, University.
3. Class Room Methods and Expedients.
   (Ten minute talks)
   First Lessons in Geometry,
   Miss Marion S. Gerls, Detroit.
   Algebraic Laws and Geometry,
   Mr. L. D. Wines, Ann Arbor.
   An Experiment in Geometry,
   Miss Gertrude L. Roper, Detroit.
   The First Semester in Algebra,
   Mr. F. E. Wilcox, Grand Rapids.

BIOLOGICAL CONFERENCE

(Admission by badge)

Thursday Afternoon, April 3

Chairman—Prof. Wm. E. Praeger, Kalamazoo College, Kalamazoo.

Secretary—Miss Helen B. King, Saginaw.

Plans and Discussions of new courses in Botany, Zoology, Civic Biology, and Agricultural Botany for Secondary Schools.

1. A Reconsideration of the High School Course in Botany,
   Professor James B. Pollock, University of Michigan.
2. Discussion,
   Miss Jessie McNall, Hastings.
3. A Course in Zoology,
   Prof. Jessie Phelps, State Normal College.
4. Discussion,
   Miss Grace Ellis, Grand Rapids.

Friday Afternoon, April 4

Civic Biology—A New Plan for the High School Course by Dr. C. F. Hodges of Clark College, Worchester, Mass.
A presentation of material sent in advance from the April publication of Dr. Hodges new text-book of Civil Biology,
Miss Ellen Bach, Kalamazoo High School.

Discussion,
Professor Le Roy Harvey, Western Normal School, Kalamazoo.

A New Course in Agricultural Botany,
Professor Walter French, Michigan Agricultural College.

Discussion,
Mr. A. McVittie, St. Johns.

COMMERCIAL CONFERENCE

(Admission by badge)

Thursday Afternoon, April 3

2:00 o'clock

ROOM C-16, HIGH SCHOOL

Chairman—Mr. D. W. McMillan, Detroit.
Secretary—Mr. S. A. Moran, Ann Arbor.

1. Growth of Commercial Education,
   Professor David Friday, University of Michigan
2. Commercial Training in the High School,
   Principal E. E. Gallup, Adrian.
3. Discussion.

Friday Afternoon, April 4

2:00 o'clock

ROOM B-8, HIGH SCHOOL

4. Commercial Law,
   Mr. Ivan E. Chapman, Eastern High School, Detroit.
5. Making Advanced Dictation Practical,
   Mr. W. N. Glass, Cass Technical High School, Detroit.
6. General Discussion.
7. Suggestions as to the Nature of Next Year's Program to be given before the General Meeting of the Club.
8. Business Meeting.

PHYSIOGRAPHY CONFERENCE

(Admission by badge)

Friday Afternoon, April 4

1:30 o'clock

GEOLOGICAL LABORATORY, ECONOMICS BUILDING

Chairman, Miss Helen M. Martin, Battle Creek.
Secretary—Miss Bernice L. Haug, Detroit Central.

1. Physiography as Seen by an Outsider,
   Professor C. O. Davis, University.
2. Reasons For a Thorough Geography Preparation in the Elementary Schools,
   Professor J. M. Mandeville, Sill School, Detroit.
3. Physiography: Its Malady and a Suggested Remedy,
   Professor Frank Carney, University of Michigan.
4. An Elementary Science Course,
   Miss Florence J. Woodworth, Muskegon.

5. Field Methods in Geologic Mapping,
   Professor Frank Leverett, U. S. G. S.
6. Progress of Topographic Mapping in Michigan,
   Dr. R. C. Allen, State Geologist.
7. Relation of Physiography to History, Literature, and to Other Sciences,
   Superintendent F. W. Frostic, St. Charles.
8. Sources bar Commercial Geography Study,
   Mr. C. B. Bowerman, Central High School, Detroit.
9. Physiography vs. High School Geography,
   General Discussion led by Professor L. H. Wood, Western State Normal.

DRAWING CONFERENCE

(Admission by badge)

Friday Afternoon, April 4

1:30 o'clock

ART LECTURE ROOM, MEMORIAL BUILDING

Chairman—Miss Alice Viola Guysi, Detroit.
Secretary—Miss Kate B. Conover, Central High School, Detroit.

1. Business Meeting.

2:30 o'clock

2. The Physical Side of the Book,*
   Mr. Theodore Wesley Koch, Librarian, University of Michigan.

The Exhibit of Drawing will be held in Memorial Hall and will be in charge of Mr. Raymond Everett, Instructor in Drawing, University of Michigan.

MANUAL TRAINING CONFERENCE

Thursday Afternoon, April 3

2:00 o'clock

ROOM B-2, HIGH SCHOOL

Chairman—Mr. S. S. Judd, Saginaw.
Secretary—Miss Maude Fuller, State Normal College.

1. State Aid for Vocational Education,
   Superintendent S. O. Hartwell, Kalamazoo.
2. Vocational Guidance,
   Principal Jesse B. Davis, Central High School, Grand Rapids.

* Illustrated with stereopticon.

3. To What Extent Can the School Shop Approach the Actual Conditions of the Factory,
   Mr. J. H. Trybon, Director of Manual Training, Detroit.
4. A Commercial Product of the School Shop,
   Mr. L. R. Abbott, Director of Manual Training, Grand Rapids.

EDUCATIONAL PSYCHOLOGY CONFERENCE

Thursday Afternoon, April 3

2:00 o'clock

ROOM B-1 HIGH SCHOOL

Chairman—Professor S. B. Laird, State Normal College.
Secretary—Professor H. C. Lott, State Normal College.

1. The Value of Psychological Tests in Determining Standards of Mental Efficiency,
   Dr. George B. Randels, Alma College.
   Discussion,
   Dr. E. C. Rowe, Central Normal School,
   Superintendent E. C. Warriner, Saginaw.
2. The Present Status and Future Prospects of Experimental Pedagogy,
   Professor F. S. Breed, University of Michigan.
   Discussion,
   Professor N. A. Harvey, State Normal College.
   Superintendent C. E. Chadsey, Detroit.
3. General Discussion.

MICHIGAN INTERSCHOLASTIC ATHLETIC ASSOCIATION

Thursday Afternoon, April 3

5:15 o'clock

ROOM B-8 HIGH SCHOOL

Chairman—Principal J. B. Edmonson, Jackson.
Secretary-Treasurer—Mr. G. G. Bechtel, Detroit.

1. General Discussion of Interscholastic Athletics.
2. Election of Officers.

Members of the Schoolmasters' Club

Life Members

SWARTHMORE, PA.
Dennison, Walter

UNIVERSITY
Kelsey, F. W.

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Gallup, E. E.
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Breed, Gertrude
Chute, H. N.
Essery, E. E.
Jocelyn, L. P.
Porter, Alice
Slauson, H. M.
Springer, D. W.
Wines, L. D.
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Coburn, W. G.
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Arbury, Fred W.
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Cooke, C. S.
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Hull, Isabella H.
Irwin, F. C.
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Miner, Mary L.
Pettee, Edith E.
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Gold, Mary E. S.
Nutt, H. D.
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Allison, Clara J.
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Hartwell, S. O.
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LOCKPORT, ILL.
Swain, G. R.
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Everett, J. P.
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Peet, B. W.
Strong, E. A.
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Lee, L. B.
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McCarroll, Sarah
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Diekhoff, T.
Dow, E. W.
Finney, B. A.
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Markley, J. L.
Newcombe, F. C.
Ziwet, Alexander
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Hickey, T. P.
Waldo, D. B.
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Arbaugh, W. B.
Jones, L. H.
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Bennett, Ella M.
Breed, Gertrude
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Essery, E. E.
Goodell, F. Maude
Jocelyn, L. P.
Lusby, Lulu V.
McCain, A. B.
O'Brien, Sarah
Porter, Alice
Ray, Anna M.
Slauson, H. M.
Springer, D. W.
Sturgis, Martha
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Butler, L. A.
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Arbury, Fred W.
Hull, Lawrence C.
Spain, C. L.
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Comfort, B. F.
Cooke, C. S.
Cooper, L. G.
Flintermann, Emilie A.
Phelps, Nancy S.
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Bechtel, G. G.
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Conover, L. Lenore

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Darnell, Albertus
Gee, E. F.
Goldman, Miriam D.
Hull, Isabella H.
Irwin, F. C.
Lowry, Florella R.
Mackenzie, David
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Rivett, B. J.
Sargeant, Charlotte H.
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Wentworth, W. H.

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McSweeney, Amelia
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Pettee, Edith E.
Strubel, R. H.

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Roper, Gertrude

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Liggett, Miss J. M.

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Wagner, T. E.

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Bancroft, Nellie E.
Bates, Angie
Corns, J. H.
Elliott, Lucy
Frutig, Marie L.
Hempsted, Johanna K.
Kerns, Martha
Matthews, J. W.
Meiser, Augusta B.
Merrill, John W.
Morse, Wm. A.
Waples, Marcia
Weir, W. W.

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Wood, Helen L.

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Nutt, H. D.
Wade, C. G.

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Hartwell, S. O.

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Williams, C. B.
Williams, Geo. A.

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Swain, Geo. R.

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Phelps, Jessie
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Wilber, H. Z.

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Scott, I. D.
Tilley, M. P.
Van Tyne, C. H.
Williams, N. H.
Winkler, Max
Ziwet, Alexander

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Hine, Katherine G.
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Lowry, Florella R.
Mackenzie, David
Malcomson, Rachel
Millard, Grace G.
Miller, E. L.
Plee, Nellie O.
Rivett, B. J.
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Thompson, Margaret E.
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Barney, Blanch K.
Bates, Angie
Corns, J. H.
Coughlan, Nina
Elliott, Lucy
Farnsworth, Mary F.
Frutig, Marie L.
Hempsted, Johanna K.
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Ludke, C. W.

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Smith, Grace
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Weir, W. W.
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Wiltsie, Katherine D.

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McNall, Jessie

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Gier, S. J.

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Mauck, J. W.

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Josenhans, R. J.
Marsh, E. O.

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Worth, E. N.

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Praeger, W. E.
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Williams, Geo. A.

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Wright, L. L.

LEADVILLE, COLO.
McWilliams, L. D.

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Swain, Geo. R.

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Kirchhofer, Marie

MANISTIQUE
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MARINE CITY
Hazelton, R.

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Heitsch, Grace
Riggs, W. D.

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French, W. H.

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Gilday, Selma
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Smith, R. C.

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Craig, J. A.

NILES
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Wilber, H. Z.

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OXFORD, OHIO
Bishop, Elizabeth L.

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Fyan, Lila E.
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McDonald, A.
Outwater, Olive
Stark, Helen

ROMEO
Muma, J. A.

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Warriner, E. C.

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Lorch, Emil
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Running, T. R.

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Scott, I. D.
Talamon, Rene
Thieme, H. P.
Tilley, M. P.
Trueblood, T. C.
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Wagner, C. P.
Williams, N. H.
Winkler, Max
Ziwet, Alexander

VICKSBURG
Smith, P. H.

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Burnham, Ernest
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Hickey, T. P.
Parsons, Maude
Waldo, D. B.

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Arbaugh, W. B.
Hardy, Carrie A.
Jones, L. H.
Ross, De Forest

List of Members for 1913

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Blanchard, C. W.
Curtis, A. E.
Fox, Frances
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Gallup, Mrs. E. E.
Irish, Ella P.
Irland, Helen
Priddy, Bessie M.
Schaible, Ida M.

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Carey, Eleanor J.
Langworthy, F. M.
McDiarmid, L. A.

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Demorest, F. C.
Fall, Delos
Goodrich, F. S.
Greene, C. W.

ALLEGAN
Scalf, Fred

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Cook, A. P.
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Haefliger, Marie
West, Francis E.

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Morell L. G.

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Adams, O. V.
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Bennett, Ella M.
Breed, Gertrude
Brightman, Hazel
Brown, Jessie
Chute, H. N.
Conklin, Hope
Essery, E. E.
Freeman, O. W.
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Jocelyn, L. P.
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McAllister, H. A.
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Russell, H. R.
Shaw, Edith W.
Slauson, H. M.
Springer, D. W.
Steere, Edith
Sturgis, Martha
Sudworth, Gertrude
Ulrich, Mary
Walsh, May
West, Jeannette S.
Wines, L. D.

ATHENS
Teninga, Gertrude

BATTLE CREEK
Benson, Walfred
Coburn, W. G.
Krell, Carrie
Mann, Jessie
Martin, Helen M.
Oxby, Hilda
Schroeder, Meta

BAY CITY
Basler, C. D.
Beese, Julia H.
Bothe, Eva
Eckert, A. C.
Gates, Mrs. E. L.
Gauthier, R. H.
German, W. L.
Grinnell, E. M.
Hassett, E. A.
Hunker, Emma G.
Hunter, I. B.
Keating, Florence A.
Kern, Kate
Liskow, Julia
Lowrie, Lovina C.
MacGregor, Helen
MacGregor, Mary
McGinnis, E. K.
McKinney, Mary
McLaughlin, James
Merrill, Frances H.
Olson, Florence
Paxton, R. D.
Rich, L. H.
Robinson, Florence B.
Schroeder, Matilda
Sharpe, E. M.
Skinner, G. H.
Sloan, N. B.
Taylor, Harriet L.
Ten Eyck, H. E.
Wells, Berta A.

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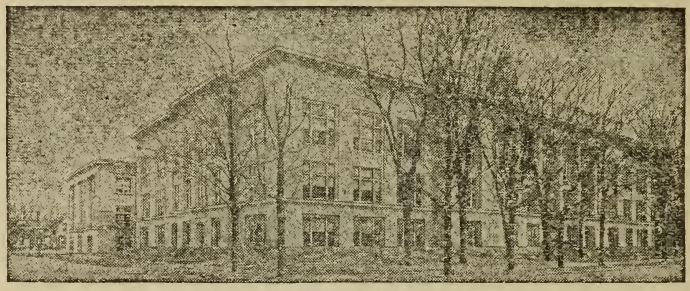

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